BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

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

FEBRUARY, 1941.

I.—SUB-ATOMICS.

Lines of the quartet system in silver. R. N. Rai (*Sci. and Cult.*, 1936, **1**, 520—521).—The first 7 pairs of terms $^2D_{5/2}$ and $^2D_{3/2}$, arising from the $4d^95s^2$ state, are classified.
CH. ABS. (*e*)

Breadth of the 2537 A. mercury line in the under-water-spark spectrum. F. Asmuss (*Ann. Physik*, 1939, [v], **36**, 737—752).—The half-width (*w*) of the line has been measured for sparks between Hg–Cd, –Sn, and –Pb alloy electrodes under H_2O, and rotating mirror photographs of the sparks have been taken. *w* depends largely on the [Hg] in the alloy, and since the total absorption shows a high concn. of Hg atoms in the absorbing layer the observed broadening is a pressure effect. Linear extrapolation to $p_{Hg} = 0$, with an assumed temp. of 4500° K., gives $p = 35$ atm. in the absorbing layer, but extrapolation based on Trumpy's results (A., 1927, 179) gives a more probable val. of 12 atm.
A. J. E. W.

Atomic energy values of ionised tellurium (Te II). K. R. Rao and M. G. Sastry (*Nature*, 1940, **146**, 523; cf. A., 1939, I, 290).—From analysis of the spectrum of Te$^+$, abs. vals. of the characteristic terms are reported. The ionisation potential of Te$^+$ is ~21·5 v., as given by the largest Te$^+$ term $5p^4S_{1\frac{1}{2}}$.
L. S. T.

Zeeman effects in the arc spectrum of ruthenium. G. R. Harrison and J. R. McNally, jun. (*Physical Rev.*, 1940, [ii], **58**, 703—708).—Measurements on resolved Zeeman patterns of 450 lines of Ru I, and term vals. and *g* vals. determined from the various patterns, are tabulated. When data from the various lines arising from a given term are averaged, *g* vals., apparently correct to ±0·003, are obtained for 140 terms. Results are used to extend the classification of Ru I, and to aid in the assignment of *L* and *S* vals. to highly perturbed terms. Asymmetrical patterns in lines arising from the terms $y\ ^5D_3^0$ and $y\ ^5D_4^0$ are discussed.
N. M. B.

Soft X-ray spectroscopy of solids. I. K- and L-emission spectra from elements of the first two periods. H. W. B. Skinner (*Phil. Trans.*, 1940, **A**, **239**, 95—134).—The soft X-ray emission bands of Li, Be, Na, Mg, Al, B, diamond, graphite, Si, P, and S at 40—500 A. have been systematically re-investigated with a concave-grating spectrograph connected directly to the X-ray tube; in some experiments the anti-cathode was cooled with liquid O_2. The observed bands are considered in detail with reference to the density functions representing the at. energy levels, and a characteristic difference is shown to exist between the bands of metals and non-metals. The character of the band edges and of the " tailing " of the bands is discussed; with metals the effect of temp. on the edges is related to a Maxwellian distribution of conductivity electrons, while thermal expansion has some effect. A large broadening of the valency levels of lowest energy is proposed as a characteristic feature of the solid state. The interpretation of the bands is almost complete, and the properties of the system of levels can be deduced in detail in sp. cases. Lattice structure has a predominant effect on the nature of the bands.
A. J. E. W.

Soft X-ray spectroscopy of solids. II. Emission spectra from simple chemical compounds. H. M. O'Bryan and H. W. B. Skinner (*Proc. Roy. Soc.*, 1940, **A**, **176**, 229—262; cf. preceding abstract).—*K* and *L* emission bands were investigated for a no. of halides, oxides, sulphides, and carbides. Spectra from both atoms of the compound were recorded for SiC, BN, and a no. of oxides. The results are interpreted to give the characteristics of the bands of levels which exist for the valency electrons in the normal state of the substance.

For the halides data on the *p*- and *s*-levels are given; the crystal structure is found to influence the form of the bands of levels. In most oxides there is evidence of interaction between electrons in neighbouring atoms. The spectra of metal ions in oxides are very complex.
G. D. P.

Coefficient of mass intensity reduction of monochromatic X-rays for 24 elements between carbon (6) and cerium (58), for wave-lengths of 0·1279—1·433 A. W. Wrede (*Ann. Physik*, 1939, [v], **36**, 681—695).—Vals. of the coeff., μ/ρ, are measured for C, F, Mg, Al, S, Cl, Ca, Ti, V, Cr, Mn, Fe, Co, Zn, As, Se, Br, Sr, Zr, Mo, Sb, Te, I, and Ce, as elements or compounds with other light elements. The log (μ/ρ)–log λ curves are straight lines for the heavier elements, but become increasingly convex towards the log λ axis as the at. no. (*Z*) decreases. The results are represented by the relation $\mu/\rho = C\lambda^n + f(\lambda)(\sigma_0/\rho)$, in which $f(\lambda) = 1/(1 + 0·048/\lambda)$. Vals. of *C*, *n*, and the classical mass scattering coeff. σ_0/ρ (which is ~0·2 for the lighter elements and is neglected for elements heavier than Zn) are given; *C* increases and *n* decreases with rising *Z*. The log (μ/ρ)–log *Z* curves are linear at high $\lambda\lambda$.
A. J. E. W.

Influence of gas pressure on striking voltage of an alternating-current arc. S. Hoh and Y. Hanawa (*Electrotech. J.*, 1938, **2**, 151—154; *Chem. Zentr.*, 1938, ii, 3373).—The influence of gas pressure ($p = 1$—31 atm.) and arc current (*I* amp.) on the striking voltage (*V*) and changes of arc voltage with time has been studied with an oscillograph, using an arc between 2-mm. Cu electrodes 5 mm. apart, in air. The *V*–*p* curves have a max. ($p = 16$) with $I = 9·7$, but fall continuously with $I = 100$. At $I = 10$ a glow discharge precedes formation of the arc on striking. At $I = 100$ and $p = 30$ electrons are emitted from the cathode by a thermionic mechanism.
A. J. E. W.

Striking mechanism of long discharge tubes. II. Effect of pre-ionisation on striking. W. Bartholomeyczyk and E. Wolter (*Ann. Physik*, 1940, [v], **37**, 124—136; cf. *ibid.*, 1939, [v], **36**, 485).—The striking of a discharge in Ne (pressure *p*) in a long tube with an auxiliary pre-ionising discharge (current *I*) at one end has been studied. The dependence of striking voltage on *p* and *I* and the current variations and field distribution previous to striking are examined, and discussed with reference to the mechanism of the striking process.
A. J. E. W.

Thermal ionisation of strontium. B. N. Srivastava (*Proc. Roy. Soc.*, 1940, **A**, **176**, 343—351).—Experiments were carried out at different temp. and pressures to determine the equilibrium concn. of Sr$^+$ and electrons in Sr vapour. The results agree with the theory of thermal ionisation and the known spectroscopic data.
G. D. P.

Charge of the β-particle. R. Ladenburg and Y. Beers (*Physical Rev.*, 1940, [ii], **58**, 757).—The charge was determined directly by measuring the charge deposited per sec. on a Faraday collector at the exit slit of a β-ray spectrometer and, after replacing the collector by a Geiger–Müller counter, by counting the no. of particles emerging per sec. To obtain an accurately measurable collector current, a strong source was used for the collector measurements, and the beam was then reduced by a known ratio for the counter measurements by allowing the source to decay. Series of measurements at five vals. of $H\rho$ on a Ra-E source gave the mean val. $-4·84_0 \times 10^{-10}$ e.s.u. ±0·6% probable error. Sources of error are discussed.
N. M. B.

Reflexion of positive rays and release of secondary electrons from metallic surfaces. A. Rostagni (*Ric. sci. Progr. tecn. Econ. naz.*, 1938, [ii], **9**, I, 633—634; *Chem. Zentr.*, 1938, ii,

3517).—A new apparatus for measurements on the neutralisation of positive rays has been tested. Data are given for the release of electrons from Mo, Ni, and clean and contaminated Cu surfaces by Ne^+ and He^+ (velocities 3·3–1140 v.). A. J. E. W.

Change of charge of helium canal rays in gases. H. Meyer (*Ann. Physik*, 1940, [v], **37**, 69—75; cf. A., 1938, I, 5).—Equilibrium vals. of the ratio (n_1/n_2) of He^+ to He^{++} ions are determined by magnetic analysis of He canal rays (energy $E = 30$—200 ke.v.) after passage through a column of gas. With H_2 or air in this column n_1/n_2 falls rapidly from high vals. as E increases, but with He the vals. of n_1/n_2 for low E and the subsequent fall are both much smaller. The pressure-dependence of n_1/n_2 gives a mean free path for the transition from He^+ to He^{++} of 2300 cm., in air at 10^{-3} cm. pressure with $E = 171$ ke.v., whilst that for the reverse process is 80 cm. A. J. E. W.

Uses of charged water vapour. Y. Toriyama, K. Togasawa, Y. Ichimura, and S. Shiratori (*Electrotech. J.*, 1938, **2**, 217—218; *Chem. Zentr.*, 1938, ii, 3582).—A method of ionising H_2O or other vapour in a corona discharge is described. Dust particles charged negatively by the ionised vapour are removed from air by an electric field. A. J. E. W.

Lateral diffusion of a stream of ions in a gas. L. G. H. Huxley (*Phil. Mag.*, 1940, [vii], **30**, 396—413).—Mathematical. The spatial distribution of ions or of electrons moving in a steady stream through a gas in a uniform electric field is determined theoretically by an analysis which affords solutions in a form convenient for purposes of practical computation and leads to some theoretical generalisations. Important practical cases are discussed and the effects of magnetic fields are considered. O. D. S.

Measurement of nuclear magnetic moments with radio waves. C. J. Gorter (*Nederl. Tijds. Natuurk.*, 1938, **5**, 97—101; *Chem. Zentr.*, 1938, ii, 3364—3365; cf. A., 1937, I, 18, and Rabi *et al.*, A., 1938, I, 173, 293).—Higher energy densities are conveniently reached with radio frequencies than with radiation in any other part of the spectrum. A. J. E. W.

Range-groups of natural H rays. J. Riedl (*Anz. Akad. Wiss. Wien, math.-nat. Kl.*, 1938, 55; *Chem. Zentr.*, 1938, ii, 3366).—The energy spectrum of protons ejected from paraffin by α-rays from Po has been examined photographically. Groups with ranges in air of 7·7, 10·1, 11·9, and 13·2 cm. are found; the second and fourth correspond with Frank's first two groups. A. J. E. W.

Scattering of 2·5-Me.v. neutrons in helium. J. A. Wheeler and H. H. Barschall (*Physical Rev.*, 1940, [ii], **58**, 682—687). —From the observations of Barschall and Kanner (cf. A., 1941, I, 2), the existence at 2·5 Me.v. of a coupling between the spin and orbital motion of the neutron is deduced. There is some evidence of appreciable interaction between a neutron and an α-particle of 2 units of mutual angular momentum, the classical distance of closest approach of which would be 7×10^{-13} cm. N. M. B.

Internal pair production in radium-C'. R. Thomas (*Physical Rev.*, 1940, [ii], **58**, 714—715).—Mathematical. Ra-C' shows a sharp line of 1·4-Me.v. conversion electrons with no corresponding quanta. Hence the nuclear transition is probably between states of zero angular momentum and like parity. The calc. ratio of pair production to internal conversion of both K electrons for this process is ~0·6%. N. M. B.

Existence of thorium-polonium. J. Schintlmeister (*Anz. Akad. Wiss. Wien, math.-nat. Kl.*, 1938, 55; *Chem. Zentr.*, 1938, ii, 3366).—Attempts to detect a new α-radiation due to decomp. of Th-D have been unsuccessful. If an α-active Th-F (" Th-Po ") exists, the half-life of Th-D, -E, or -F is $>1·0 \times 10^{13}$ years. ^{208}Pb (Th-D) is not the only parent of ^{204}Pb. A. J. E. W.

Reactions produced by neutrons in heavy elements. E. Fermi (*Science*, 1940, **92**, 269—271).—An address. L. S. T.

Magnetic lens for β-rays of high energy. V. E. Cosslett (*J. Sci. Instr.*, 1940, **17**, 259—264).—A magnetic electron lens of considerably greater focussing efficiency than that of the Fe-shrouded type is described. The fields produced are capable of focussing electrons of 15 Me.v. energy at a focal length of 37·5 cm., without cooling of the coils, and with cooling it could be used for electrons of 20 Me.v. energy. The

optimum conditions for using the lens as a β-ray spectrometer are discussed. The lens has been used in an attempt to detect high-energy electrons from a possible disintegration of Li by slow neutrons, $^7Li + n_0 \rightarrow {}^8Li \rightarrow {}^4He + {}^4He + e^- + 15·9$ Me.v., but with negative results. This provides independent confirmation of the observation that Li does not behave similarly when bombarded with deuterons and with slow neutrons. A. J. M.

Resonance scattered protons from ^{11}B and ^{19}F. W. R. Kanne, R. F. Taschek, and G. L. Ragan (*Physical Rev.*, 1940, [ii], **58**, 693—695).—With B(OMe)$_3$ and BF$_3$ as the scattering gases, preliminary work in search of resonance scattering, manifested by a deviation from Rutherford angular distribution for protons of the resonance energy, gave negative results, but upper limits for it were established and a sensitive method for observing small deviations from Rutherford scattering is described. The proton energy producing the resonance in B is 163 ± 6 ke.v. N. M. B.

Scattering of α-particles by carbon and oxygen. A. J. Ferguson and L. R. Walker (*Physical Rev.*, 1940, [ii], **58**, 666—671).—Observations of scattering at large angles, with solid targets, and with Ra-C' as a source, give results showing resonances in C at energies 5·5, 5·0, and 4·4 Me.v. and indicate that the angular momentum quantum no. of the compound nucleus ^{16}O is probably 2 for the highest level and >0 for the others. Resonances at 6·5 and 5·5 Me.v. were observed in O, indicating excited states of ^{20}Ne with angular momentum probably 1. N. M. B.

Nuclear energy levels in magnesium. T. R. Wilkins and G. Wrenshall (*Physical Rev.*, 1940, [ii], **58**, 758).—The angular distribution curve for 6·9-Me.v. protons scattered by Mg shows elastic and inelastic peaks, the inelastic fraction varying markedly with the scattering angle. The peak separations corresponded with ~1·3 Me.v. energy difference. Results are compared with those of Al. N. M. B.

Radioactive isotopes of vanadium. L. A. Turner (*Physical Rev.*, 1940, [ii], **58**, 679—681; cf. Walke, A., 1940, I, 141).—A review of experimental evidence indicates that V (600 days) should be attributed to ^{49}V rather than to ^{47}V. The relatively low yield of ^{50}V in the (d, n) reaction and of ^{52}V in the (a, p) reaction suggests the existence of undiscovered long-lived isomerides of $^{50, 52}$V. N. M. B.

Decay of ^{80}Br (4·5 hr.). D. De Vault and W. F. Libby (*Physical Rev.*, 1940, [ii], **58**, 688—692; cf. A., 1939, I, 173).—Evidence of a limit of $85 \pm 4\%$ to the chemical extractibility of Br (18 min.) from Br (4·5 hr.) is presented, and this is interpreted as the fraction of Br (4·5 hr.) which emits conversion electrons. γ-Rays of ~30—40 ke.v. average energy were found coming from Br (4·5 hr.) (cf. Grinberg, A., 1940, I, 384). The presence of a γ-ray accompanying Br (18 mm.) is confirmed, but its energy is placed above 0·6 Me.v. N. M. B.

Artificially radioactive element 85. D. R. Corson, K. R. MacKenzie, and E. Segrè (*Physical Rev.*, 1940, [ii], **58**, 672—678; cf. A., 1940, I, 186).—Bi bombarded with 32-Me.v. α-particles becomes radioactive and emits α-particles of 6·55 and 4·52 cm. ranges (not genetically related), a γ-ray of ~0·5 Me.v. energy, an X-ray or soft γ-ray of ~80 ke.v. energy, a soft X-ray, and low-energy electrons. All these radiations have the same half-life of 7·5 hr. Evidence indicates that the disintegrating substance is element 85 going to Po by K-electron capture. The probable mechanism is : ^{209}Bi $(a, 2n)$ ^{211}85; the ^{211}85 decays either by K-electron capture to Ac-C' (^{211}Po) or by α-particle emission (range 4·5 cm.) to ^{207}Bi. The 6·5-cm. α-particles are those of Ac-C'. According to this scheme the second branch from ^{211}85 leads to ^{207}Bi which should decay to ^{207}Pb (not yet found). The chemical properties of element 85 are discussed. N. M. B.

Passage of uranium fission fragments through matter. W. E. Lamb, jun. (*Physical Rev.*, 1940, [ii], **58**, 696—702).— The ranges and rates of energy loss of the fission fragments of U are calc. on the basis of a model in which the charge of the fragment is obtained from its energy and its successive ionisation potentials. The energy-loss cross-section for protons of the same velocity is then used to calculate the ranges of the two groups of fragments. For $Z_1 = 42$, $A_2 = 100$ these are 2·42, and for $Z_2 = 50$, $A_2 = 136$ 2·08 cm., for a total assumed kinetic energy of 188 Me.v. and a final kinetic energy of the lighter fragment of 5 Me.v. These are in fair agreement with

the observed ranges of 2·2 and 1·5 cm. The experimental and theoretical range–energy relations are also in fair agreement. The validity of the model is discussed, and appears fairly good for fragments >5 Me.v. The initial charges of the fission fragments are 17 and 13. The density of ionisation decreases along the track, in marked contrast to the behaviour for protons and α-particles.   N. M. B.

Radioactive barium and strontium from photo-fission of uranium. A. Langer and W. E. Stephens (*Physical Rev.*, 1940, [ii], **58**, 759; cf. Haxby, A., 1940, I, 341).—In order to determine whether photo-fission produces the same radioactive elements and with similar relative yields as neutron fission, U was irradiated with slow neutrons, with fast neutrons, and with γ-rays, Ba and Sr were separated chemically, and decay curves examined. These show the production of Ba (86 min.) and Sr (6 hr.) by neutron- and by photo-fission. The ratio of the initial activity of the two products is approx. the same for both slow and fast neutron fission as for γ-fission.   N. M. B.

Latitude effect of extensive cosmic-ray showers. H. V. Neher and W. H. Pickering (*Physical Rev.*, 1940, [ii], **58**, 665—666).—Owing to statistical fluctuations of the results, measurements of large cosmic-ray shower intensities on the Pacific Ocean lead to no positive conclusions on the latitude effect.   N. M. B.

Essential assumptions of a theory of atomic structure. L. A. Goldblatt and A. H. Croup (*J. Chem. Educ.*, 1940, **17**, 378—379).—A summary of modern views of at. structure.   L. S. T.

Inelastic scattering of a beam of particles by hydrogen and helium. K. C. Kar (*Phil. Mag.*, 1940, [vii], **30**, 487—504; cf. A., 1938, I, 4).—Mathematical. The previously developed theory is extended to inelastic scattering leading to excitation. Its application to the experiments of Dymond and Watson (Proc. Roy. Soc., 1929, **122**, 571), Van Atta (A., 1931, 1206), and Mohr and Nicoll (A., 1932, 1185) is discussed.   O. D. S.

Connexion between spin and statistics. W. Pauli (*Physical Rev.*, 1940, [ii], **58**, 716—722).—Mathematical. For the relativistically invariant wave equation for free particles, the postulate of positive energy leads to Fermi–Dirac statistics for particles with arbitrary half-integral spin, and the postulate of commutativity of observables on different space-time points with a space-like distance leads to Einstein–Bose statistics for particles with arbitrary integral spin.   N. M. B.

Relativistic self-consistent field for Cu$^+$. A. O. Williams, jun. (*Physical Rev.*, 1940, [ii], **58**, 723—726).—Mathematical. From the improved Hartree self-consistent field solution, by substitution of the Dirac relativistic one-electron equation for the Schrödinger one-electron equation, the numerical solution, without exchange, for the inner shells of Cu$^+$ is outlined, and tables of the resulting energy parameters and charge density distribution are given and discussed.   N. M. B.

Operator calculus in the electron theory of metals. K. Fuchs (*Proc. Roy. Soc.*, 1940, **A**, **176**, 214—228).—A calculus is developed applicable to the electron theory of metals. It differs from the common operator calculus of the quantum theory in that the wave function is defined in the at. polyhedron, and this leads to the introduction of surface operators.   G. D. P.

Inner excited states of the proton and neutron. W. Heitler and S. T. Ma (*Proc. Roy. Soc.*, 1940, **A**, **176**, 368—397).—To avoid the difficulties of applying the meson theory to the interaction of fast mesons with nuclear particles it is proposed that the charge and spin of an electron can assume higher quantum states. The theory is developed and the possibility of observing the new particles is discussed.   G. D. P.

II.—MOLECULAR STRUCTURE.

Relation between potential energy and interatomic distance in diatomic molecules. J. W. Linnett (*Trans. Faraday Soc.*, 1940, **36**, 1123—1134).—The reciprocal-exponential expression $V = a/r^m - be^{-nr}$ is shown to be more satisfactory than either a double-reciprocal or a double-exponential function for representing the variation of potential energy with the distance between two bonded atoms. The expression is ex-

amined in detail and tested against experimental data for a no. of diat. mols.   F. L. U.

Spectroscopic evidence of the B$_2$ molecule and determination of its structure. A. E. Douglas and G. Herzberg (*Canad. J. Res.*, 1940, **18**, **A**, 165—174).—A new ultra-violet band system observed in a discharge in He containing a trace of BCl$_3$ has been attributed to B$_2$ and the vibrational and rotational structures have been analysed. The electronic transition is probably $^2\Sigma_u^- \rightarrow {}^3\Sigma_g^-$. The lower (ground) state has a vibrational frequency $\omega_0 = 1041\cdot9$ cm.$^{-1}$, internuclear distance $r_0 = 1\cdot594$ A., and force const. $k_0 = 3\cdot52 \times 10^{-5}$ dynes per cm. The nuclear spin of ^{11}B derived from the intensity alternation is 5/2, which does not agree with recent theoretical predictions, based on the Hartree model and on the α-particle model of the nucleus.   F. J. G.

Emission spectrum of antimony nitride. (Miss) N. H. Coy and H. Sponer (*Physical Rev.*, 1940, [ii], **58**, 709—713; cf. A., 1938, I, 293).—In a discharge through a mixture of N$_2$ and Sb vapour a new band system of SbN is found, and from the vibrational analysis a formula for the heads is obtained. A comparison of mol. consts. for N$_2$, PN, AsN, and SbN suggests that the electronic transition for the new system is $^1\Pi \rightarrow {}^1\Sigma$.   N. M. B.

Ultra-violet absorption of nitrous oxide. J. Nicolle (*Publ. Fac. Sci. Univ. Paris*, 1940, 34 pp.).—Absorption measurements for λλ 2150—2350 A. at 20° and −90° and 100—760 mm. pressure are reported, and mol. extinction coeffs. are calc. Results are discussed with reference to available data and give an approx. absorption limit at 2350 A., from which, with the help of the heat of dissociation of N$_2$ and data on the spectra in the Schumann region, the probable mechanism of photochemical reactions of N$_2$O are deduced. No pressure effect is found, but there is a temp. effect between 20° and −90° which can be explained on the assumption of a steep slope in the potential energy curve of the system NO + N.   N. M. B.

Infra-red absorption studies. XI. NH–N and NH–O bonds. A. M. Buswell, J. R. Downing, and W. H. Rodebush (*J. Amer. Chem. Soc.*, 1940, **62**, 2759—2765).—The absorption spectrum of NH$_2$Ph is discussed. The shift of 85 cm.$^{-1}$ to shorter λλ may be insufficient to merit the attribution of H-bonding. When small energies of H-bond formation are involved it is possible that factors other than H-bonding come into play. All proteins exhibit absorption in the 3 μ. region. Spectra of acetylglycine Et ester (solid and in CCl$_4$) and Et 3 : 5-dimethyl-pyrrole-2-carboxylate (in CCl$_4$) show peaks possibly attributable to NH–N and NH–O bonds. To prove the existence of characteristic νν for these bonds NHPh$_2$ (solid and in CCl$_4$) and mixtures of NHPh$_2$ with NMe$_2$Ac have been investigated. Evidence for NH–N bonds but not for NH–O bonds is thereby obtained. From examination of solid films of NH$_2$Ac, CCl$_3$·CO·NH$_2$, Bu^{a}CO·NH$_2$, diketopiperazine, glycine, alanine, and NH$_2$·SO$_3$H it is shown that proteins have similar spectra to N-substituted amides and contain isolated NH–O′ bonds (3·0 μ.) and NH–O′ bonds in pairs (3·22 μ.). The peptide linking is considered to be NH–O. The NH–O′ bond has the same frequency as the NH–N. The amide group has the co-planar structure —C(O⁻):N which persists in proteins, therefore giving *cis*- and *trans*-H atoms.   W. R. A.

Hydrogen bridging in cellulose as shown by infra-red absorption spectra. J. W. Ellis and (Miss) J. Bath (*J. Amer. Chem. Soc.*, 1940, **62**, 2859—2861).—In the region 1—2·5 μ. cellulose (ramie) fibres in a mixture of CS$_2$ and CCl$_4$ ($n \simeq 1\cdot57$) show two bands at 1·51 and 1·58 μ., indicating the presence of OH vibrators perturbed by H-bonding, and a weak band at 1·44 μ., indicating that few unperturbed OH groups exist in the mol. These conclusions are substantiated by the spectrum in the 2 μ. region.   W. R. A.

Electron transition–vibration combinations in the spectra of praseodymium salts. (Fr.) A. Hellwege (*Ann. Physik*, 1940, [v], **37**, 226—248; cf. A., 1939, I, 508).—The complete absorption spectrum of Pr$_2$Zn$_3$(NO$_3$)$_{12}$,24H$_2$O (I) (including polarisation data) at 16,800—23,000 cm.$^{-1}$, and relevant portions of the spectra of Pr(NO$_3$)$_3$,6H$_2$O and Pr$_2$(SO$_4$)$_3$,8H$_2$O, are recorded; photometer curves are given for some systems. Certain data are also given for Pr(EtSO$_4$)$_3$,9H$_2$O, Pr$_2$Mg$_3$(NO$_3$)$_{12}$,24H$_2$O, and Pr$_2$Zn$_3$(NO$_3$)$_{12}$,24D$_2$O. The splitting of various terms in the

cryst. field is not in accord with Bethe's theory. As in the case of Nd salts (Ewald, A., 1939, I, 118) the lines may be assigned to electronic transitions with superimposed external or internal lattice vibrations. In the (**I**) spectrum certain electron transitions forbidden by symmetry appear in combination with lattice vibrations, the intensity increasing with the ν of the latter. Combinations of external lattice vibrations give some lines which are stronger than lines for pure transitions, but internal lattice vibrations give much weaker lines.   A. J. E. W.

Ultra-violet absorption and fluorescence of luminol at different p_H values. E. Briner and E. Perrottet (*Helv. Chim. Acta*, 1940, **23**, 1253—1257).—In solutions of $p_H < 6$ the ultra-violet absorption spectrum of luminol shows max. at 2900 and 3500 A., but in solutions of $p_H > 7$ there is only a flat max. at 3200 A. The fluorescent form is the one yielding the two max. The narrow p_H range (7—8) over which luminol shows fluorescence suggests the possibility of its use as fluorescent p_H indicator.   J. W. S.

Chemical war materials. XVIII. Ultra-violet absorption and dipole moments of some compounds of similar structure to $\beta\beta'$-dichlorodiethyl sulphide. H. Mohler and J. Sorge. **XIX. Chemical and spectroscopic properties of $\beta\beta'\beta''$-trichlorotriethylamine (skin poison) and its hydrochloride.** H. Mohler and W. Hämmerle (*Helv. Chim. Acta*, 1940, **23**, 1200—1211, 1211—1216).—XVIII. The absorption spectra of H_2O or C_6H_{14} solutions of various derivatives of Et_2O and Et_2S have been measured in the region 2000—3500 A., and are compared with the spectra of furan and thiophen. The results accord with the view that interaction occurs between the H and Cl atoms in compounds of the type of $S(CH_2 \cdot CH_2Cl)_2$ (**I**) (cf. A., 1938, I, 557). From measurements on solutions in C_6H_6 and C_6H_{14} the following dipole moments (in D.) are deduced; $O(CH_2 \cdot CH_2 \cdot OH)_2$ 2·31, $OEt \cdot [CH_2]_2 \cdot OH$ 2·10, $OEt \cdot CHMe \cdot OH$ 1·62, $OEt \cdot [CH_2]_2 \cdot Cl$ 2·18, $CHClMe \cdot O \cdot [CH_2]_2 \cdot Cl$ 1·76, $CHClMe \cdot OEt$ 1·81, and $O(CH_2 \cdot CH_2Cl)_2$ 2·40.

XIX. The properties of $N(CH_2 \cdot CH_2Cl)_3$ (A., 1935, 849) (**II**) and its hydrochloride (**III**) are described. The absorption spectra of solutions of (**II**) in C_6H_{14} and in EtOH are identical, but that of (**III**) in EtOH is displaced slightly to shorter λ. The form of the absorption curve is similar to that for heterocyclic ring compounds. The vesicant action of the compound suggests that this property of (**I**) is attributable to the $\cdot CH_2 \cdot CH_2Cl$ groups.   J. W. S.

Effect of molecular environment on absorption spectra of organic compounds in solution. I. Conjugated dienes. H. Booker, L. K. Evans, and A. E. Gillam (*J.C.S.*, 1940, 1453—1463).—Experimental data on the absorption spectra of compounds containing the chromophore present in conjugated dienes, *e.g.*, $CH_2 \cdot CH \cdot CH \cdot CH_2$, are collected in order to discover the effect of well-defined mol. environments on the spectra. The absorption max. due to this chromophore lies within the limits 2170—2820 A. (for compounds in EtOH solution), and the intensity may rise to $\varepsilon = 35,000$, but is usually 8000—20,000. The following classes of compounds are recognised : acyclic dienes with no, one, or two cyclic substituents, semicyclic dienes, and mono-, di-, and polycyclic dienes. The introduction of a single saturated cyclic substituent into the simple butadienes lowers the val. of ε considerably, but the introduction of two such groups causes ε to increase again. Semicyclic dienes have absorption max. very close to those of acyclic dienes with a single cyclic substituent. $\lambda\lambda_{max}$ are considerably longer for monocyclic dienes than for acyclic dienes, and ε is much smaller. In polycyclic dienes, the arrangement of the conjugated system in one or in two rings, respectively, has a marked effect on the position of the absorption max.   A. J. M.

Ultra-violet absorption spectra of lignin and related compounds. R. E. Glading (*Paper Trade J.*, 1940, **111**, *TAPPI Sect.*, 288—295).—The absorption spectra of spruce native lignin and its derivatives show that at ~280 mμ. the absorption coeff. $\propto$ the amount of native lignin in the material, but this does not hold for (*a*) lignins in which the non-lignin material has a high absorption coeff. near 280 mμ., (*b*) methanol-lignins, or (*c*) lignins isolated from woods by an alkaline agent. Observed and calc. absorption coeffs. of PhOH- and PhSH-native lignins are in fair agreement. By comparing the spectra of β'-hydroxychalcone, flavanone, quercetin, native lignin, and demethylated acetylated Willstätter

lignin it was concluded that the spectrum of native lignin could be explained by assuming that each building unit of it contained two pyran rings which give rise to the absorption at 281 mμ. The non-appearance of the 352 mμ. band in the spectra of native lignin and other lignins is attributed to the almost complete enolisation of the $C{:}O$ group which gives rise to this band.   W. R. A.

Effect of crystal orientation on the Raman spectrum of calcite. S. Bhagavantam and B. P. Rao (*Current Sci.*, 1940, **9**, 409—410).—Previously reported anomalies in the intensities of the components of the 1084 cm.$^{-1}$ line of $CaCO_3$ at particular crystal orientations (A., 1940, I, 195) have been traced to inadequate control of polarisation and collimation.   W. R. A.

Raman spectra and molecular structure of aliphatic cyclic compounds. B. D. Saksena (*Proc. Indian Acad. Sci.*, 1940, **12, A**, 321—336).—The Raman displacements and their depolarisation factors have been measured for *cyclo*-hexane (**I**), -hexanol (**II**), -hexanone (**III**), dioxan (**IV**), and paraldehyde (**V**). Assuming that (**I**) is a puckered hexagon, symmetry S_{6u}, the character table, symmetry co-ordinates, no. of ring vibrations, selection rules, and no. of vibrations for the mol. are derived. Experimental data are in accord and indicate that (**I**) has a *trans* symmetry for the ring. (**II**), (**III**), and (**V**), have puckered structures. (**IV**) is predominantly in the *trans*-form but some *cis*-form is also present.   W. R. A.

Raman spectra and hydroxyl frequencies of fatty acids. B. D. Saksena (*Proc. Indian Acad. Sci.*, 1940, **12, A**, 312—320).—Raman spectra for $CCl_3 \cdot CO_2H$ (**I**) (solid, molten, 25 and 75% aq. solutions), $CHCl_2 \cdot CO_2H$ (**II**), AcOH, and HCO_2H are recorded and discussed. The behaviour of various $\nu\nu$ of (**I**) on fusion or dissolution enables the assignments of $\nu\nu$ to polymerides, monomeride, and the $CCl_3 \cdot CO_2^-$ ion. From the position of the OH frequency it is concluded that (**I**) is strongly associated. All four acids show O–H bands, the displacements (in cm.$^{-1}$) from the normal val. of the OH frequency being : HCO_2H 398, AcOH 408, (**II**) 324, (**I**) 612. Force consts. for various linkings in HCO_2H and AcOH are suggested.   W. R. A.

Quenching of resonance radiation of sodium. R. G. W. Norrish and W. MacF. Smith (*Proc. Roy. Soc.*, 1940, **A, 176**, 295—312).—The effective cross-section for quenching Na resonance radiation by saturated and unsaturated hydrocarbons, *tert.* amines, and several diat. mols. was measured. As regards quenching ability the gases fall into two groups, the saturated hydrocarbons and inert. gases being weakly quenching, the unsaturated hydrocarbons and amines strongly quenching. Within any one series the no. of atoms in a mol. appears to have little influence on the quenching ability which, it is concluded, arises from a centre of unsaturation.   G. D. P.

Relations between colour and constitution of organic silver salts and their spectral sensitivity distribution. G. Ungar (*Radiologica*, 1938, **2**, 49—56; *Chem. Zentr.*, 1938, ii, 3527).—The spectral sensitivity curves of a no. of white and coloured org. Ag salts have been determined. The white salts (particularly Ag salicylate emulsions and salts of simple salicylic acid derivatives) give broad max. at 540—570 mμ. With coloured salts the colour, rather than the constitution, determines the sensitivity. The max. for yellow salts and Ag eosin are at 500—600 mμ.; other red salts are sensitive only at <550 mμ., and the sensitivity, like that of green and grey salts, increases with decreasing λ.   A. J. E. W.

Electro-optical properties of broken-down zinc sulphide-copper phosphors. F. Goos (*Ann. Physik*, 1940, [v], **37**, 76—88; cf. A., 1939, I, 58).—When ZnS–Cu phosphors are broken down by α-rays, absorption, primary photoelectric current, and extinction effects develop at long $\lambda\lambda$. The "red effect" on the primary current also occurs in ZnS crystals, and increases with the degree of breakdown; it is due to separation of Zn in the lattice. A method of studying this effect without interference of polarisation and after-effects is described. The extinction effect, which is followed by the change of dielectric const., is also attributed to separation of Zn, but it is a sp. phosphorescence effect involving the emissive centres and is thus distinct from the red effect.   A. J. E. W.

Yellow and red zinc silicate phosphors. G. R. Fonda (*J. Physical Chem.*, 1940, **44**, 851—861).—The prep., at 850° and

by fusion, of Zn_2SiO_4 fluorescing yellow and red is described. The presence of amorphous Zn_2SiO_4 is essential for yellow fluorescence whilst red fluorescence occurs with an amorphous complex of SiO_2 and ZnO with the amount of $SiO_2 >$ that corresponding with Zn_2SiO_4. To obtain the yellow phosphor a rate of cooling, essentially rapid, must be chosen which allows crystallisation of SiO_2, but not of Zn_2SiO_4. If neither crystallises the red phosphor is formed; if both crystallise the green is formed. The green variety is formed if the reaction is allowed to proceed too far as a result of too high a temp., the presence of a catalyst, or the use of too fine oxides.
C. R. H.

Dielectric constants of some metallic sulphates containing various amounts of water of crystallisation. C. K. Cheng (*Phil. Mag.*, 1940, [vii], **30**, 505—515).—A method of measurement of the dielectric const. ϵ of powdered salts by suspending them in mixed liquids of similar ϵ and determining ϵ of the mixture for which no change in ϵ occurs on addition of the solid is described. ϵ of $CuSO_4,5H_2O$, $CuSO_4,H_2O$, $MgSO_4,7H_2O$, $MgSO_4,H_2O$, $ZnSO_4,7H_2O$, $ZnSO_4,H_2O$, and $FeSO_4,7H_2O$ have been measured. The mol. polarisation P of the H_2O mol. in the first three pairs of compounds is calc. on the assumption that P of the crystal is the sum of the P vals. of its component mols., and is found in all cases to be approx. equal to but slightly $> P$ of the H_2O mol. in ice.
O. D. S.

Electric moments of substituted benzoic acids. C. S. Brooks and M. E. Hobbs (*J. Amer. Chem. Soc.*, 1940, **62**, 2851—2854).—The following vals. for electric moments in dioxan at 30° are given : PhCl, 1·61; PhBr, 1·58; BzOH, 1·78; m- and p-$C_6H_4Br\cdot CO_2H$, 2·15 and 2·08 D. The angle made by CO_2H with the C–C line is ~76° compared with 85° calc. from additivity of bond moments; the discrepancy is explained on the basis of resonance. Resonance is used also to explain why p-$C_6H_4Cl\cdot CO_2H$ has a moment $<$ that of p-$C_6H_4Br\cdot CO_2H$. The free rotation of the CO_2H group has been studied but no definite conclusions could be drawn.
W. R. A.

Additivity of molecular volumes. II. Molecular volumes of paraffin hydrocarbons. N. F. Komschilov (*J. Gen. Chem. Russ.*, 1940, **10**, 945—949).—The mol. vols. of isomeric paraffin hydrocarbons differ, being least when the constituent atoms are grouped around a central atom, and greatest with terminally branched chains. Increments for radicals substituted into different atoms of chains are derived empirically.
R. T.

Molecular volume of butadiene at different pressures. B. A. Dolgoplosk and Korneev (*Sintet. Kautschuk*, 1936, No. 4, 15—18).—Within the limits 20·9 mm. to 1376 mm. at 15° and 56·1 mm. to 778·3 mm. at 0° deviations from the ideal gas are proportional to the partial pressure of butadiene. The mol. vol., $v = 22\cdot41[1 - \lambda(P - 100)]$, where P is the partial pressure of butadiene and $\lambda = 0\cdot000044$ at 15° and $0\cdot00005$ at 0°.
Ch. Abs. (e)

Theory of structure of hydrides of boron. B. V. Nekrassov (*J. Gen. Chem. Russ.*, 1940, **10**, 1021—1030).—The analogy between B hydrides and hydrocarbons is only an apparent one. The former are considered to be co-ordination complexes of B^{III}.
R. T.

Stereochemical types and valency groups. N. V. Sidgwick and H. M. Powell (*Proc. Roy. Soc.*, 1940, A, **176**, 153—180).—Bakerian lecture. The spatial arrangements of the covalencies of a multivalent atom, while subject to small variations (usually <5° or 10°), tend to conform to a limited no. of types. This grouping is related to the size of the valency group of the central atom, the no. of shared electrons it contains, and that of the preceding (unshared) electronic group in the atom. The relations shown by the experimental results are described.
G. D. P.

Approach to magnetic saturation. W. F. Brown, jun. (*Physical Rev.*, 1940, [ii], **58**, 736—743).—Mathematical. If the internal forces responsible for the incompleteness of saturation vary rapidly over shorter distances, instead of being approx. uniform over distances containing a large no. of atoms as in the standard treatment, the interat. coupling forces prevent the direction of microscopic magnetisation from varying with equal rapidity, and the $1/H^2$ law no longer follows. The forms taken by the law under various conditions are deduced and interpreted.
N. M. B.

Formulation of ions electronically. G. N. Copley (*Chem. and Ind.*, 1940, 815—816).—It is unnecessary to indicate that an electronic formula represents an ion by enclosing it in brackets and suffixing a $+$ or $-$ sign, or otherwise indicating polarity. In some cases, *e.g.*, SO_4'', it is impossible to allocate positions to the $+$ or $-$ signs. It is illogical to use the same symbol to represent the neutral atom and the core, but no confusion arises by doing so.
A. J. M.

Molecular fields of force : retrospect and suggestions. S. Chapman (*Nature*, 1940, **146**, 607—609).
L. S. T.

Image and van der Waals forces at a metallic surface. J. Bardeen (*Physical Rev.*, 1940, [ii], **58**, 727—736).—Mathematical. Calculations based on a model which takes the structure of the metal into account indicate that the force on an electron outside the surface is the classical image force, but that the van der Waals force on a neutral mol. may be smaller than that given by a semi-classical calculation based on the method of images. An approx. val. of the van der Waals energy between two systems is obtained, and the method leads to a new approx. formula for the van der Waals interaction between two mols. The relation to the energy found by the image method is examined.
N. M. B.

Properties of liquids in fine capillaries. I. Surface tension and density. L. H. Cohan and G. E. Meyer (*J. Amer. Chem. Soc.*, 1940, **62**, 2715—2716).—γ and ρ for H_2O and PhMe have been measured at 23° in capillaries of diameter as small as 4μ. and vals. are in agreement with normal vals. It is concluded that the explanation given by Shereshefsky (A., 1929, 128) that lowering of v.p. in fine capillaries is due to increase in γ is inadmissible.
W. R. A.

Physical properties and chemical constitution. VI. Saturated and unsaturated cyano-esters. D. M. Cowan and A. I. Vogel (*J.C.S.*, 1940, 1528—1531).—n^{20} for C, D, F, and G' lines and ρ and γ over a range of temp. have been determined for $CN\cdot CH_2\cdot CO_2Et$, $CRR'{:}C(CN)\cdot CO_2Et$ (RR' = MeEt, EtEt, MePr^a, EtPr^a, Pr^{a}Pr^a) and $CHRR'\cdot CH(CN)\cdot CO_2Et$ (RR' = MeMe, MeEt, EtEt, MePr^a, EtPr^a, Pr^{a}Pr^a). The mol. refractivities and parachors have been computed and compared with calc. vals. The observed parachors are $<$ calc. vals. Mol. refractivities show an exaltation of the unsaturated esters, due, probably, to the conjugated system $>C{:}C{:}N$. Vals. of $>CH_2$ groups are listed; the parachor val. is $<$ the accepted val. of 39—40 units.
W. R. A.

III.—CRYSTAL STRUCTURE.

Extra spots of the Laue photograph. (Sir) W. Bragg (*Nature*, 1940, **146**, 509—511).—Conditions under which a pattern of diffuse spots will be produced are discussed. Predicted positions of diffuse spots for the X-ray photograph of KCl are compared with those shown on the photograph itself, and show good agreement.
L. S. T.

Modified reflexion of X-rays. (Sir) C. V. Raman and P. Nilakantam (*Nature*, 1940, **146**, 523).—The geometric law of quantum or modified reflexion is given by $2d \sin \frac{1}{2}(\theta + \phi) = n\lambda$, where d is a crystal spacing, and θ and ϕ are the glancing angles of incidence and reflexion with respect to such spacing. The formula shows that the angle between the incident and reflected rays is independent of the setting of the crystal. The actual crystal spacing and the vals. of d calc. from $n\lambda = (\sin \theta + \cos \theta \tan \phi)$ (cf. A., 1940, I, 285) do not agree. The well-defined character of the quantum reflexions given by an ideal crystal is illustrated by a photograph of a strongly-exposed Laue pattern of calcite.
L. S. T.

Comparison of the use of crystal-reflected and filtered X-rays in liquid diffraction patterns. R. Q. Gregg and N. S. Gingrich (*J. Sci. Instr.*, 1940, **11**, 305—307).—X-Ray diffraction patterns of liquid Na have been obtained with the Mo $K\alpha$ doublet under conditions of monochromatisation by calcite or rock-salt reflexion, or by filtration through ZrO_2 filters. Sharp patterns were obtained with calcite or rock-salt reflexion. With filtered radiation spurious peaks were observed in the pattern. The sharpness and accuracy of the pattern with filtered radiation can be improved by decreasing the tube voltage and the width of the collimating slits, but the intensity is then $<$ that obtained by rock-salt reflexion. The latter is the most convenient method of monochromatisation.
O. D. S.

Technique for X-ray powder photography of reactive metals and alloys, with special reference to the lattice spacings of

magnesium at high temperatures. G. V. Raynor and W. Hume-Rothery (*J. Inst. Metals*, 1939, **65**, *Advance copy*, 477—485).—Filings of Mg prepared by hand-filing in air contain only 98·95—99·27% Mg, and under paraffin 99·3—99·6% Mg. A glass apparatus has been designed by means of which it is possible to prepare fine drillings containing 99·98% Mg by using a dental drill in an atm. of A and transferring the filings through a sieve into a SiO_2 capillary in the same atm. X-Ray examination of these filings at 10° and at 310° gave lattice consts. of : at 10°, a 3·2017, c 5·1986, c/a 1·6237; at 310°, a 3·2278, c 5·2423, c/a 1·6241. By filling the tube with paraffin the following vals were obtained at 597° : a 3·2599, c 5·2772, c/a 1·6245. Up to 310° (= 0·63 × m.p. in ° K.) expansion is linear, the coeff. being 27·2 × 10^{-6} perpendicular to the hexagonal axis and 28·1 × 10^{-6} parallel thereto. Between 455° and 600° the mean vals. of these coeffs. become 39·3 and 40·2 × 10^{-6}, respectively. A. R. P.

X-Ray structure and elastic strains in copper. S. L. Smith and W. A. Wood (*Proc. Roy. Soc.*, 1940, **A**, **176**, 398—411).—An X-ray examination of Cu was made while the metal was under stress. It is shown that the permanent strain is associated with breakdown of the grains and that this change is irreversible. The elastic strain is accompanied by reversible changes in dimensions of the at. lattice, which take place without leaving any permanent distortion in the lattice. Quant. measurements were made on strains exhibited by the (400) and (331) planes and these are compared with the equiv. external elastic constants. The measurements show that marked differences of strain may exist in neighbouring grains and provide an explanation of the extensive breakdown of the grains into components of widely different orientation which characterises the structure of a polycryst. metal after deformation beyond the elastic limit. G. D. P.

Crystal structure of CuMg₂. (Miss) G. Ekwall and A. Westgren (*Arkiv Kemi, Min., Geol.*, 1940, **14**, **B**, No. 7, 8 pp.).—$CuMg_2$ is orthorhombic, with a 5·273, b 9·05, c 18·21 A., and 16 mols. in unit cell. A. J. M.

Crystal structure of cementite. H. Lipson and N. J. Petch (*Iron and Steel Inst.*, Sept., 1940, *Advance copy*, 9 pp.).—The position of the C atoms in Fe_3C has been established by direct calculation of the electron density in two different planes of the unit cell. The structure is orthorhombic, a 4·5144, b 5·0787, c 6·7297 A., unit cell containing 12 Fe and 4 C atoms, space-group *Pbnm*. The Fe atoms are almost close-packed with the C atoms in the interstices. A diagram of the probable structure is given and its relation to the ferrite and austenite structures is briefly discussed. A. R. P.

Modified reflexion of X-rays by crystals : calcite. S. Bhagavantam and J. Bhimasenachar (*Proc. Indian Acad. Sci.*, 1940, **12**, **A**, 337—339).—Modified X-ray reflexions from (211) planes of calcite, due to Cu K_α and K_β radiations, lead to an approx. const. spacing in good agreement with the accepted val. of 3·029 A. W. R. A.

Orthorhombic crystalline modification of diphenyloctatetraene. K. S. Krishnan, S. L. Chorghade, and T. S. Anantapadmanabhan (*Trans. Faraday Soc.*, 1940, **36**, 1153—1155).—A detailed account of work previously published (A., 1940, I, 432). F. L. U.

Crystal chemistry of the phosphates, arsenates, and vanadates of the type A₃XO₄(Z).—See A., 1941, I, 64.

Classification of Kossel–Möllenstedt electron interferences in space-lattice theory. M. von Laue (*Ann. Physik*, 1940, [v], **37**, 169—172; cf. *ibid.*, 1939, [v], **36**, 113).—Theoretical. A. J. E. W.

Electron diffraction investigation of molecular structure of dilead hexamethyl. H. A. Skinner and L. E. Sutton (*Trans. Faraday Soc.*, 1940, **36**, 1209—1212).—The main bond distances in Pb_2Me_6 are : Pb—Pb 2·88±0·03 A., Pb—C 2·25±0·06 A. F. L. U.

Electron diffraction investigation of molecular structure of aluminium trimethyl in the vapour phase. N. R. Davidson, J. A. C. Hugill, H. A. Skinner, and L. E. Sutton (*Trans. Faraday Soc.*, 1940, **36**, 1212—1225).—Al_2Me_6 has an C_2H_6-like structure, in which the distances are : Al—Al 2·02± 0·06 A., Al—C 2·05±0·05 A.; C—Al—Al = 105±10°. Various models are described and discussed. It is not possible to determine whether the C atoms are in the "staggered" or

"eclipsed" positions, nor whether the Me groups are free to rotate. F. L. U.

Magnetic measurements on active aluminium oxides and hydroxides. K. E. Zimens (*Svensk Kem. Tidskr.*, 1940, **52**, 205—222).—The question whether there is a direct connexion between magnetic properties and imperfections of lattice structure is discussed in the light of published instances of changes in magnetic properties accompanying the formation of active states of various paramagnetic solids. Vals. of χ for various preps. of γ-Al_2O_3, γ-AlO·OH, γ-Al(OH)$_3$, and α-Al_2O_3 are recorded. A slight dependence of χ on temp. is to be attributed to its dependence on H_2O content, which is discussed; there is no connexion between χ and the various active states. F. J. G.

Theoretical study of a possible model of paramagnetic alums at low temperatures. J. A. Sauer and H. N. V. Temperly (*Proc. Roy. Soc.*, 1940, **A**, **176**, 203—213).—The model is a lattice of freely suspended magnets, all interactions except purely magnetic being neglected. Theory predicts that the state of lowest energy is either a spontaneously magnetised state for a long thin specimen or a state in which alternate rows of magnets point in opposite directions for a sphere; spontaneous magnetisation appears in an ellipsoid when the eccentricity exceeds a certain crit. val. The effect of shape on magnetic properties is in qual. agreement with experiment. G. D. P.

Distribution of autelectronic emission from single crystal metal points. I. Tungsten, molybdenum, nickel in the clean state. M. Benjamin and R. O. Jenkins (*Proc. Roy. Soc.*, 1940, **A**, **176**, 262—279).—The field emission from points of 0·5 μ. diameter is observed under different conditions of temp. It is found that surface mobility occurs above 1170° κ. for W, 770° κ. for Mo, and 370° κ. for Ni. The changes in the distribution of intensity in the patterns are explained in terms of a change of geometrical shape of the point, caused by the high external field acting on the mobile surface atoms. The flash-over phenomenon is discussed and the effect of traces of gas investigated. Suggestions are put forward to explain the dependence of emission on the crystal structure of the metal. G. D. P.

Location of hysteresis phenomena in Rochelle salt crystals. W. P. Mason (*Physical Rev.*, 1940, [ii], **58**, 744—756; cf. A., 1939, I, 307; Mueller, A., 1940, I, 287).—A theoretical formulation of the equations of motion of a piezoelectric crystal, taking account of the dissipation effects, is made. The frequency variation of the clamped ϵ, when interpreted by Debye's theory of dielectrics, modified to take account of hysteresis losses, indicates that there are two components, one of which, having associated with it a high viscous resistance, has $\epsilon = \sim$140 at 0° and is probably due to the dipoles of the Rochelle salt; the other, a non-viscous component, has $\epsilon = \sim$100 at 0°, and is probably due to the displacement of the ions in the lattice structure. Both components have higher ϵ and hysteresis between the Curie points, indicating a co-operative action of the mols. for both components in this temp. region. N. M. B.

Electrification of powdered insulators. (Sir) A. Fleming (*Proc. Physical Soc.*, 1941, **53**, 51—53; cf. A., 1939, I, 307).—Experiments with S or dry SiO_2 powders poured in a stream on to a metal plate show that the charge developed is not entirely due to the particles impinging on the metal but is partly obtained in the process of pouring. An apparatus is described, consisting of a long tube containing perforated Zn plates and closed at the ends by metal canisters, whereby on repeated reversal, on the hour-glass principle, the falling SiO_2 powder causes the canisters to acquire a cumulative charge, and this can be used to charge a condenser. Electrons tend to pass from the medium of high electron density (Zn plate) to the falling insulator powder. N. M. B.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES.

Reduction of the Wiedemann–Franz law of thermal and electrical conductivity of metals to an absolute form. L. Laboccetta (*Ric. Sci. Progr. tecn. Econ. naz.*, 1938, [ii], **9**, I, 262—263; *Chem. Zentr.*, 1938, ii, 3521). A. J. E. W.

Adiabatic temperature changes accompanying the magnetisation of ferromagnetic materials in low and moderate fields. L. F. Bates and J. C. Weston (*Proc. Physical Soc.*,

1941, **53**, 5—34).—A new simplified method for measuring heat changes accompanying magnetisation processes in fields of $\sim$ a few hundred oersteds is described. The adiabatic temp. changes of a rod taken step by step through a hysteresis cycle are measured by a series of thermocouples of which the hot junctions are directly attached to the rod. The sensitivity is $\sim 10^{-6}$° and ~ 330 ergs per c.c. Detailed results and curves for pure annealed and hard-drawn Ni and Ni–Fe alloys, strained and unstrained, are given, effectively proving War-burg's law and enabling a detailed analysis of the energy changes accompanying magnetisation to be made. They accord with Becker's views on magnetisation processes in ferromagnetics, but do not support Preisach's conception of the formation of demagnetisation nuclei in the case of very soft ferromagnetics.　　　　N. M. B.

Ferromagnetism and its carrier in the system manganese-bismuth. K. Thielmann (*Ann. Physik*, 1940, [v], **37**, 41—62).—Mn powder reacts with molten Bi at 272—600° in the absence of air to give a ferromagnetic material, generally in powder form. Analysis of a magnetic extract of the powder shows indirectly that the ferromagnetic constituent is BiMn. Debye–Scherrer photographs of suitably prepared compacted specimens show that BiMn has a NiAs structure with a 4·26$_0$, c 6·07$_0$ A., c/a 1·42$_4$, V 95·3$_9$ cu. A. A method of preparing the alloys in rod form, and an improved Weiss apparatus for their magnetic examination, are described. The effect of heat-treatment on the enrichment of BiMn is studied by magnetic and microscopical methods. The hysteresis loop shows saturation at $\sim 10^4$ gauss. The magnetisation rises slowly between 250° and 30°, and then more rapidly, and reaches a max. at −180°; this temp.-dependence and the Curie temp. (343±2°) are approx. independent of the Mn content of the alloy. BiMn has a saturation moment of 3·13 Bohr magnetons, probably due to the Mn atom. BiMn is compared with analogous P, N, As, and Sb compounds.　　　　A. J. E. W.

Dissociation of hexaphenyldiplumbane. R. Preckel and P. W. Selwood (*J. Amer. Chem. Soc.*, 1940, **62**, 2765—2766).—Sp. magnetic susceptibility, χ, and ρ have been measured for Pb_2Ph_6 in C_6H_6 between 30° and 80° and at 0·01547 and 0·02265м. The upper limit of dissociation is calc. as 1·4% compared with 0·1% for the solid state. The dissociation into $PbPh_3$, which would be paramagnetic, is unlikely (cf. Foster *et al.*, A., 1939, II, 460).　　　　W. R. A.

Variation of the magnetic susceptibility of hæmin in various solvents. W. A. Rawlinson (*Austral. J. Exp. Biol.*, 1940, **18**, 185—192).—The low magnetic moment of hæmin in purified C_5H_5N is probably due to a small amount of combination between the C_5H_5N and the hæmin. C_5H_5N-parahæmatin gave a magnetic moment of 1·97, which corresponds with one unpaired electron, the six covalent bonds from the Fe atom being arranged octahedrally. When sucrose is added to an alkaline solution of hæmin, the moment rises from 3·6 to 5·6. The magnetic moment of hæmatin in 0·2n-NaOH suggests the presence of intermediate (dsp^2) type of chemical linkings from the Fe atom.　　　　D. M. N.

Absorption of sound in carbon dioxide. R. W. Leonard (*J. Acoust. Soc. Amer.*, 1940, **12**, 241—244).—Using a direct method for measurements over frequencies 22—112 kc., a microphone responding to sound pressure is moved away from a piston source in a flat surface, the output of the microphone is amplified and recorded photographically, and the resulting pressure–distance curve yields the pressure attenuation coeff. Results accord with theory (cf. Bourgin, A., 1936, 1189). The lowest frequency val. at which μ, the absorption per λ, is a max. is 30 kc. This max. is accounted for by assuming that the symmetrical valency vibration and the deformation vibration are effective in producing the absorption, and that the second harmonic of the deformation mode also participates in the absorptive process. Velocity measurements show a reasonable agreement between dispersion and absorption.　　　　N. M. B.

Absorption of sound in five triatomic gases. E. F. Fricke (*J. Acoust. Soc. Amer.*, 1940, **12**, 245—254).—Measurements of sound absorption coeffs. over 8—130 kc. for CO_2, N_2O, COS, CS_2, and SO_2 are reported. The frequencies of max., absorption are 20, 153, 287, 379, and 1040 kc., respectively. For the linear mols. CO_2, N_2O, COS, and CS_2, a linear relation exists between the max. absorption coeffs. and the frequencies at which these max. occur. Other acoustic relationships are described. Reaction rates, probabilities of removal of

vibrational quanta, the no. of collisions necessary to remove energy quanta, and the no. of quantum transitions per sec. are calc. A technique for finding the frequencies of max. absorption at frequencies beyond the scope of the apparatus is presented.　　　　N. M. B.

Absorption of sound in carbon dioxide, nitrous oxide, carbonyl sulphide, and carbon disulphide containing added impurities. V. O. Knudsen and E. Fricke (*J. Acoust. Soc. Amer.*, 1940, **12**, 255—259, cf. preceding abstract).—The addition of certain gases, such as H_2, H_2O, H_2S, MeOH, etc., as "catalysts" shifts the absorption bands to higher frequencies, and the magnitudes of the shifts yield information regarding the frequency at which each pure gas has its max. absorption, the nature of the mol. collisions involved, and the effectiveness of the collisions in disturbing the vibrational states of the absorptive mols. Results show that at atm. pressure and 23° the absorption max. for pure CO_2, N_2O, COS, and CS_2 are shifted in each case by amounts $\propto$ the concn. of the added catalyst. Transition probabilities for the gases are calc., and these are characteristic of the colliding pair of mols.　　　　N. M. B.

Properties of thin metal layers. Y. Saito (*Electrotech. J.*, 1938, **2**, 171; *Chem. Zentr.*, 1938, ii, 3373—3374).—The transparency of thin sputtered Au films passes through a max. as the thickness (a) increases. The electrical resistance reaches a limit with $a <$ a crit. val.　　　　A. J. E. W.

Determination of the refractive index of iron by the Kundt prism method. A. Boettcher (*Ann. Physik*, 1940, [v], **37**, 278—290).—The prep. of thin Fe prisms by condensation on glass in a vac. is described; the prismatic cross-section is secured by a moving diaphragm in front of the cooled surface. In the apparatus used the prism and refraction angles are determined by microphotometer measurements on photographed cross-wire images. The n vals. obtained are 2·80± 0·02, 2·52±0·05, and 2·15±0·09 at 5780, 5460, and 4350 A., respectively.　　　　A. J. E. W.

Optical constants of thick metal layers in the visible and near infra-red. R. Kretzmann (*Ann. Physik*, 1940, [v], **37**, 303—325).—A new apparatus for the direct determination of the principal angle of incidence ($\bar{\phi}$) and principal azimuth ($\bar{\psi}$) of thick metal films is described; light from a monochromator is reflected through a system of four similar films on glass or quartz, and the intensity is measured with a photo-cell. The prep. of the films by evaporation is described; their thickness is measured from Newton's rings. Cu, Ag, and Au films have been studied at 5000—10,000 A. With Cu, and to a smaller extent with Ag, $\bar{\phi}$ and $\bar{\psi}$ vary with the rate of deposition of the film, a rapidly deposited film giving higher vals. $\bar{\phi}$ and $\bar{\psi}$ for a film of given thickness do not vary with the no. of successively deposited layers used to build up the film. The dispersion variations are identical for films on glass or quartz, but with Cu and Ag $\bar{\phi}$ and $\bar{\psi}$ are slightly higher for quartz; larger differences occur with Au. Dispersion and absorption data for the films are calc.　　　　A. J. E. W.

Optical properties of phenylthiocarbamide derivatives. (Miss) M. L. Willard and (Miss) M. Z. Jones (*J. Amer. Chem. Soc.*, 1940, **62**, 2876—2877).—Optical properties (crystal habit, extinction, optic axial angles, n_a, n_β, and n_γ) for 13 derivatives of phenylthiocarbamide are recorded. From these data members of homologous series, having nearly identical m.p., may be distinguished.　　　　W. R. A.

Heat capacities of some organic compounds containing nitrogen and the atomic heat of nitrogen. II. S. Satoh and T. Sogabe (*Bull. Inst. Phys. Chem. Res. Japan*, 1940, **19**, 1244—1250).—Comparison of the mol. heats of BzOH, CHPh:CH·CO$_2$H, p-NH$_2$·C$_6$H$_4$·N:NPh, antipyrine, and PhSO$_2$·NH$_2$ with those of their NH$_2$-derivatives yields a mean val. of 4·04 g.-cal. for the at. heat of N, comparable with the val. 4·22 found with NO$_2$-compounds. No marked regularity is found in the vals. for o-, m-, and p-derivatives, but the val. in CHPh:CH·CO$_2$H derivatives is $>$ in BzOH derivatives.　　　　J. W. S.

Change of thermal expansion and electrical resistance of γ-manganese on transformation into the α-form. H. D. Erfling (*Ann. Physik*, 1940, [v], **37**, 162—168).—The mean coeffs. of linear expansion (β) of γ-Mn (for method of prep. cf. Herrmann, A., 1941, I, 53) and α-Mn at 0—20° are 14·75 and 22·29 × 10^{-6}, respectively. Except at low temp. the vari-

ation of β with T for α-Mn can be represented by a Debye temp. (Θ) of 460°; Θ for γ-Mn is probably <400°. The sp. resistances (ρ) for γ- and α-Mn are 0·39 and 6·3 × 10⁻⁴ Ω. per cm. cube, with temp. coeffs. between 0° and room temp. of 0·00628 and 0·000215. The changes of β and ρ during the γ–α transformation are recorded.   A. J. E. W.

Geometrical note on van der Waals' equation. H. Bagchi (*Indian J. Physics*, 1940, **14**, 173—185).—Van der Waals' equation has been studied mathematically in Euclidean space of three dimensions.   W. R. A.

Gas imperfection. I. Determination of second virial coefficients for seven unsaturated aliphatic hydrocarbons. E. E. Roper (*J. Physical Chem.*, 1940, **44**, 835—847).— P–V–T data over the range ~340° K. down to the normal b.p. have been obtained for C_2H_4, C_3H_6, $C(CH_2)_2$, $CH_2{:}CMe_2$, $CH_2{:}CHEt$, and *cis*- and *trans*-$(CHMe)_2$. The observed vals. for the mol. vols. show a mean deviation of ±0·06% from calc. vals. The dependence on T of the second virial coeff. (θ) in Onnes' equation of state is shown graphically, and vals. for the consts. f, g, and h in the equation $\theta = f + g/T + h/T^2$ have been calc.   C. R. H.

Generalised high-pressure properties of gases. K. M. Watson and R. L. Smith (*Nat. Petroleum News*, 1936, **28**, No. 27, 29—30, 32, 34—36).—Compressibility, fugacity, heat content, heat capacity, heat of dissolution, and expansion data are summarised.   CH. ABS. (*e*)

Phenomenological significance of thermodynamic constants. V. Njegovan (*Acta phys. polon.*, 1937, **6**, 109—129; *Chem. Zentr.*, 1938, ii, 3520).—A theoretical discussion, chiefly of the significance of internal pressure in gases and liquids.   A. J. E. W.

Theory of fusion. J. G. Kirkwood and (Miss) E. Monroe (*J. Chem. Physics*, 1940, **8**, 845—846).—Mathematical. A theory of fusion is based on the concept of an order–disorder transformation.   J. W. S.

Viscosity of carbon dioxide in the critical region. S. N. Naldrett and O. Maass (*Canad. J. Res.*, 1940, **18**, B, 322—332).— η for CO_2 in the region of the crit. temp. has been studied with an oscillating-disc viscosimeter. Equilibrium vals. are rapidly reached when the temp. is lowered, but with rising temp. from below to above the crit. temp. there is a pronounced time lag. In the region above the crit. temp. there is no min. of the η–T isochores, and η is more dependent on ρ than on T. The interpretation of these results is discussed.   F. J. G.

Combined stress and anisotropy. J. J. Guest (*Phil. Mag.*, 1940, [vii], **30**, 349—369).—Theoretical. The effect of anisotropy on the yield point is discussed, and the results of Mason (*Proc. Inst. Mech. Eng.*, 1900, 1205), Becker (*Ill. Univ. Eng. Dept. Bull.*, 1916, 84), and Cook (*Proc. Roy. Soc.*, 1932, **A, 137**, 559) are interpreted as in close agreement with the Guest criterion of elastic failure.   O. D. S.

Theory of elasticity of non-isotropic materials with applications to the problems of bending and torsion. E. Reissner (*Phil. Mag.*, 1940, [vii], **30**, 418—427).—Mathematical. The two-dimensional theory of elasticity of materials of rectilinear anisotropy and its applications are presented, with the simplifications due to the fact that one of the two elastic moduli occurring in plane stress is assumed to be zero, *i.e.*, the material is not resistant to normal stresses in a certain direction.   O. D. S.

Plasticity of the isotropic body. Y. Nakagawa (*Mem. Ryojun Col. Eng.*, 1940, **13**, 22—193).—Mathematical.   F. L. U.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

Solidification-point curves of binary [fatty] acid mixtures. II. Palmitic, stearic, arachidic, behenic, lignoceric. H. A. Schuette and H. A. Vogel (*Oil and Soap*, 1940, **17**, 155—157; cf. B., 1940, 222).—The f.p. curves (illustrated) for binary mixtures of consecutive pairs of the above acids show 3 segments with two breaks at positions corresponding with 48 and 73 mol.-%, respectively, of the acid of lower mol. wt., and are interpreted as indicating the formation of one equimol. binary compound between each adjacent pair of acids. The tendency of the curves to approach a smooth continuous form

as the mol. wt. of the acids increases suggests a decreasing tendency in the higher acids to compound formation.   E. L.

Action of non-electrolytes [on electrolytes]. P. Z. Fischer (*Bull. Sci. Univ. Kiev*, 1939, No. 4, 197—208).—A review.   R. T.

Density, heat capacity, and compressibility of solutions of electrolytes. V. K. Sementschenko (*Uspechi Chim.*, 1936, **5**, 641—661).—A review.   CH. ABS. (*e*)

Stationary and non-stationary states of flow of hydrogen in palladium and iron. R. M. Barrer (*Trans. Faraday Soc.*, 1940, **36**, 1235—1248; cf. A., 1939, I, 317, 466; 1940, I, 355).—A method depending on measurement of the time lag L in establishing a steady state of flow was used to determine diffusion coeffs. D of H in Pd and Fe; the derivation of a relation between L and D for cylindrical tubes is given. Vals. of D and of the permeability P were determined for Pd from room temp. to 350° and for Fe from 0° to 80°. Vals. of the consts. in the expressions $P = P_0 e^{-E/RT}$ and $D = D_0 e^{-E_1/RT}$ are given. When phase-boundary reactions are rate-controlling the curve of permeation rate against $\sqrt{}$c.d. (for H produced by electrolysis at a Pd or Fe cathode) shows a " foot " at low c.d. but becomes straight at high c.d.; this behaviour is accounted for by combined phase-boundary reactions and diffusion, and is not due to adsorption effects. With suitably activated Pd, phase-boundary reactions are eliminated, and permeability may then be increased 2500-fold, and the rate is independent of c.d.   F. L. U.

Alloys of aluminium and lead. A. N. Campbell and R. W. Ashley (*Canad. J. Res.*, 1940, **18**, B, 281—287).—The system Al–Pb has been studied by means of cooling curves and photomicrography. The mutual solubility is inappreciable in the solid state and small in the liquid state at <800°, but liquid Al can take up +10% of Pb into colloidal suspension. There is a eutectic at 326·8° with 0·021% of Al, and an invariant point with solid Al and two liquid layers at 658·5°, the Al-rich liquid having 98·9% of Al. Small additions (+~0·7%) of Pb increase the hardness of Al; larger amounts diminish it.   F. J. G.

Solubility measurements in the region of the critical temperature. C. H. Holder and O. Maass (*Canad. J. Res.*, 1940, **18**, B, 293—304).—Apparatus is described by means of which samples may be taken from either phase of a liquid–vapour system without disturbing the equilibrium. The solubility of C_2Cl_6 in the liquid and vapour phases of C_2H_6 in the region of the crit. temp. has been determined. A difference in the solubility, and also in ρ, between the upper and lower parts of the vessel persists above the crit. temp.   F. J. G.

Solubility of sucrose. G. Verhaar (*Arch. Suikerind. Nederl.-Indië*, 1940, **1**, 325—334).—The solubility in H_2O at 30° is 68·4 g. in 100 g. of solution, and is independent of the crystal size. Supersaturated solutions reach equilibrium only very slowly (>20 hr.). Previous work is discussed critically.   S. C.

Aromatic sulphonic acids as reagents for amino-acids.—See A., 1940, II, 365.

Soap oleosols. I. Dissolution of soap in hydrocarbons. G. E. Levant and E. L. Alperovitsch (*Kolloid. Shurn.*, 1939, **5**, 493—500).—The solubilities of numerous stearates in a hydrocarbon oil have been measured at 0—160°. For the soaps of bi- and ter-valent metals, except Ca and Ba, the solubility rises with temp. and ultimately there is complete miscibility. The solutions show marked supersaturation and appear to be lyophilic sols.   R. C.

Distribution of isomorphous salts in solubility equilibrium between liquid and solid phases. A. E. Hill, G. S. Durham, and J. E. Ricci (*J. Amer. Chem. Soc.*, 1940, **63**, 2723—2732).— The distribution data for the equilibrium between solid solutions of alums or picromerites and their aq. solutions are represented empirically by log $R_l = \log K + m \log R_s$, where K is the true distribution const. in terms of activities and m is a const. characteristic of each system and related to the attraction or repulsion between the two components in the solid phase. By comparing this equation with the theoretical equation, log $R_l = \log K + \log R_s(f_1/f_2)_s$, the relationship, $a_1 = k x_1{}^m$, between the activity, a, the mol. fraction, x, of a component, and m has been established. The three Roozeboom types of distribution for ternary solutions forming continuous solid solutions are related to the val. of m; type I

has $m = 1$ and alums belong to this class; picromerites with $m <1$, *i.e.*, positive deviations from ideality, belong to type II, whilst type III, showing negative deviations from ideality, has $m >1$. The distribution const., $R_l/R_r{}^m$ generally agrees well with vals. calc. from solubilities using an empirical regularity observed for the activity coeffs. of sulphates in the ionic strengths involved.　　　　W. R. A.

Isotherms of adsorption and of surface tension. A. K. Skrjabin (*Kolloid. Shurn.*, 1939, **5**, 831—842).—The adsorption isothermal is expressed by the equation $A = (A_\infty - A_0)$ tanh $K(c - c_0) + A_0$, A being the amount adsorbed, A_∞ the max. adsorption, c the concn., and A_0, K, and c_0 consts.
　　　　J. J. B.

Recovery of nitrous gases by adsorption. I. Adsorption of nitric oxide by silica gel. E. Briner and B. Sguaitamatti (*Helv. Chim. Acta*, 1940, **23**, 1216—1231).—The adsorption on SiO_2 gel of NO has been studied at $-78°$, $0°$, and $50°$, of O_2 at $-78°$ and $0°$, and of CO_2 at $0°$ and $50°$. The Freundlich equation is not applicable to the results with NO and O_2 at $-78°$ or with CO_2 at $0°$. At equal temp. and pressure, NO is more strongly adsorbed than O_2 but less strongly adsorbed than CO_2. SiO_2 gel containing adsorbed NO is olive-green at $0°$, and becomes garnet-red at $-78°$ and almost black at the temp. of liquid air. The reason for these colours is discussed. The increase in the velocity of reaction of NO with O_2 in SiO_2 gel is attributed to the high adsorption of the gas.　　J. W. S.

Adsorption of water vapour on silica surfaces by direct weighing. H. M. Barrett, A. W. Birnie, and M. Cohen (*J. Amer. Chem. Soc.*, 1940, **62**, 2839—2844).—The adsorption of H_2O vapour at $30°$ on powdered fused SiO_2, 230—270-mesh, has been determined between 0·01 and 26 mm. by means of an improved micro-balance of high sensitivity. Two types of adsorption were encountered, one rapid and reversible, the other slow and irreversible. Treating the SiO_2 with dil. HNO_3 reduced the reversible adsorption by 35% and a further reduction of 30% occurred on heating. The approx. area of powders was estimated by the method of Kenrick (cf. B., 1941, I, 46). The reversible adsorption is determined as a 0·1-mol. layer at 1 mm., becoming unimol. at 23 mm. Measurements of adsorption rates indicate that the process resembles diffusion of H_2O into the SiO_2.　　　W. R. A.

Adsorption of ethylene on reduced nickel. S. Iijima (*Bull. Inst. Phys. Chem. Res. Japan*, 1940, **38**, 1261—1270).—The velocity of adsorption of C_2H_4 on reduced Ni, and the total amount adsorbed, have been studied between $-95°$ and $200°$. Below $-63°$ and above $150°$ adsorption equilibrium is established in a few min., but at intermediate temp. requires longer. The author's formula is applicable to the rate of adsorption at the stage when activated adsorption occurs. The heat of adsorption calc. from the adsorption isotherm at low temp. is 5·6 kg.-cal. This is attributed to van der Waals adsorption. Freundlich's adsorption isotherm can be applied satisfactorily to the observed vals., but the log a–log p diagram contains a break. Langmuir's isotherm is not applicable, whilst Williams' formula is applicable only at low temp.
　　　　J. W. S.

Application of the hydrogen-bridge theory to sorption from solution by silica gel. A. L. Elder and R. A. Springer (*J. Physical Chem.*, 1940, **44**, 943—949).—Data for the sorption by SiO_2 gel of several org. acids from solution in H_2O and org. solvents are presented. Sorption diminishes as the no. of C atoms in the acid increases and with change in solvent, viz., $CCl_4 > PhMe > PhNO_2 > $ dioxan $> H_2O$. H-bridging between acid and SiO_2 is able in part to explain the data but mol. size and the relative extent of H-bridge formation by solvent and solute must also be taken into account. The effect of mol. size is illustrated by the tendency to form H-bridges, viz., $HCO_2H > AcOH > EtCO_2H > $ palmitic acid (**I**), being in the same order as the extent of sorption. BzOH, however, lies between HCO_2H and AcOH in its tendency to form H-bridges but lies between $EtCO_2H$ and (**I**) in its extent of sorption.　　　C. R. H.

Adsorptive properties of synthetic resins. IV. S. S. Bhatnagar, A. N. Kapur, and M. S. Bhatnagar (*J. Indian Chem. Soc.*, 1940, **17**, 361—369; cf. A., 1939, I, 608).—The % adsorption of aliphatic acids from aq. solution by acid-condensed phenolic resins increases with increasing mol. wt. of the acid but the opposite behaviour occurs with alkali-condensed resins and with NH_2- and protein-resins. A similar reduction in adsorption with increasing mol. wt.

occurs even with acid-condensed resins when the acids are dissolved in non-polar solvents. The % adsorption increases with decreasing dipole moment of the solvent. These facts can be explained on the Langmuir–Harkins theory of surface orientation by assuming that the acid phenolic resins are less polar whilst the other resins are more polar than H_2O. With the former resins the polar CO_2H of the acid will tend to orient more towards H_2O, but as the mol. wt. of the acid increases it will be more difficult to pull the longer chain into H_2O and the balance of distribution of the acid between H_2O and resin will shift towards the resin. This explanation is further strengthened by data for the relative adsorption of *cis*- and *trans*-dibasic acids. Substitution into the acid of CO_2H, OH, CN, Cl, and Br increases, whilst substitution of NH_2 and alkyl groups decreases, the % adsorption by NH_2- and protein-resins.　　　　C. R. H.

Density of sorbed and bound liquids. I. Density of water bound by starch. A. Z. Kotukov (*Kolloid. Shurn.*, 1939, **5**, 373—378).—For H_2O bound by starch, d falls from 1·81 to 1·36 with increase of the degree of hydrophilism from 0·15 to 0·25.　　　　R. C.

Ageing and coprecipitation. XXXIII. Thermal ageing of imperfect barium sulphate. I. M. Kolthoff and W. M. Mac-Nevin (*J. Physical Chem.*, 1940, **44**, 921—935).—When physically and chemically imperfect $BaSO_4$ is heated the H_2O which is slowly but quantitatively driven off is occluded, not adsorbed H_2O. When dried $BaSO_4$ is exposed to H_2O vapour it adsorbs H_2O, the thickness of the adsorbed layer increasing with the relative vapour tension. Heating of $BaSO_4$ decreases the sp. surface and it is shown that the sp. surface can be calc. from the amount of H_2O adsorbed at a relative vapour tension of 0·57. 1 mg. of H_2O adsorbed at this vapour tension corresponds with a sp. surface of 10^{19} Ba ions and an average particle size of 0·66 μ. Thermal ageing is slow at temp. $<300°$, pronounced at $500°$, and very rapid at temp. $>700°$ when it is accompanied by rapid crystallisation as a result of the combined effects of sintering and the thermal mobility of the ions. Crystallisation is accompanied by the elimination of foreign materials (*e.g.*, NaCl) which do not fit into the lattice. Occluded H_2O has no effect on the speed of ageing.
　　　　C. R. H.

Influence of sorbed vapour on the static hysteresis of wetting. M. V. Tschapek and N. B. Kretschun (*Kolloid. Shurn.*, 1939, **5**, 763—766).—The contact angle between H_2O and a mineral in air is increased by a thorough drying of the mineral before the experiment; the vals. for dried and air-dry surfaces were respectively $135°$ and $52°$ for quartz, $100°$ and $60°$ for calcite, $180°$ and $135°$ for limonite, and $92°$ and $45°$ for hornblende. A drop of H_2O in paraffin oil on dried graphite gave $125°$, and a drop of paraffin oil in H_2O $55°$; the difference was $>$ for air-dry surfaces.　　　　J. J. B.

Surface tensions of amino-acid solutions as a function of p_H. J. W. Belton and A. H. H. Twidle (*Trans. Faraday Soc.*, 1940, **36**, 1198—1208).—Surface tensions of aq. glycine (**I**), alanine (**II**), valine, cystine, and hippuric acid were measured at 25° in the p_H range 0—12. The γ–p_H curves for const. amino-acid concn. all possess one or two max. and min. For acids which increase the γ of H_2O [(**I**) and (**II**)], the p_H of the pure aq. acid corresponds with a point on the curve between a max. and a min., whilst for the remaining acids, which depress the γ of H_2O, this p_H corresponds with a min. or max. γ. The thermodynamic theory of the systems is given, and the surface excess of the various components corresponding with different portions of the curves is calc. The influence of NaCl on the behaviour of (**I**) and (**II**) solutions was also examined.
　　　　F. L. U.

Theory of non-dissolving volume [negative adsorption]. B. V. Derjaguin (*Kolloid. Shurn.*, 1939, **5**, 605—611; cf. A., 1941, I, 10).—The "non-dissolving" vol. ϕ depends on the concn. c of the "indicator" (*i.e.*, the negative adsorption Γ of a solute depends on its concn.). The theory based on Bakker's theory of surface tension leads to the equations $\phi = \varepsilon + Ce^{-Ve}$ (ε and C are const., and V is the mol. vol. of the solvent) and $\Gamma = -c\phi$. The equation for ϕ seems to agree with the experiments.　　　　J. J. B.

New technique of electrocapillary measurements. J. Jackson (*Trans. Faraday Soc.*, 1940, **36**, 1248—1252).—The method described minimises the error due to the ohmic potential drop in the column of solution in the end of the capillary; it also permits more rapid measurements.　　　F. L. U.

Monolayers of compounds with branched hydrocarbon chains. II. Effect of substitution on the packing of long hydrocarbon chains. E. Stenhagen and S. Ställberg (*Svensk Kem. Tidskr.*, 1940, **52**, 223—233).—Experiments on monolayers of a no. of long-chain org. compounds show that a chain having a small polar group (OH) near the middle lies flat in the surface unless the H on the same C atom is replaced by a larger group (Me), when the mol. assumes a "hairpin" configuration. A larger polar group (CO_2H) increases the tendency to take up this configuration, but it is still only completely attained when in addition the H is replaced by a larger group. These effects are compared with those of substituents on ring-closure and on the dissociation consts. of dibasic acids. F. J. G.

Structure and physico-chemical properties of surface layers of high-molecular compounds. II. Surface properties of agar and starch gels. V. A. Ptschelin (*Kolloid. Shurn.*, 1939, **5**, 717—722; cf. A., 1939, I, 256).—The contact angle θ between air, H_2O, and agar was 21° for 3% gel and 73° for air-dry gel. θ between C_6H_6, H_2O, and gels was larger when the gel was first brought in contact in H_2O than when it was first wetted with C_6H_6. The difference (or hysteresis) was 22° for 3% agar gel, 54° for air-dry agar, 3° for starch gel, 46° for air-dry starch, and 111° for 10% gelatin gel. The hysteresis on agar and starch was not affected by the time spent under a liquid before θ was measured. J. J. B.

Pressure-soluble and pressure-displaceable components of monolayers of native and denatured proteins. I. Langmuir and D. F. Waugh (*J. Amer. Chem. Soc.*, 1940, **62**, 2771—2793).—Monolayers of egg-albumin, gelatin, zein, insulin, gliadin, pepsin, and edestin, from which unspread mols. in the substrate have been removed by scrubbing, have been studied. Pressures (F), 10—30 dynes per cm. for 10 min., caused certain pressure-sol. components, which were detected and measured by the indicator oil method, to dissolve; this dissolution was accompanied by, and in quant. agreement with, a decrease in area (a) of the layer measured under standard F of 1 dyne per cm. Monolayers from which all pressure-sol. components had been removed by ageing at F 25—30 dynes per cm. formed (F, a) curves with reproducible loops depending on increasing or decreasing F according to a standard F–time cycle. Measurements at F >15 dynes per cm. showed that sudden increases or decreases of F produced only slight changes in a but gradual changes of a larger magnitude followed. It is concluded that the apparent large compressibility of films results from the forcing out from the air–H_2O interface of certain weakly hydrophobic NH_2-acids into a lower film where they contribute little to the surface pressure. This provides, however, a correlation of the compressibility curves of the proteins with their chemical compositions. NH_2-acids with side-chains having a hydrophobicity < that of Et determine the areas in the range F 1—3 dynes per cm., whilst greater hydrophobicity determines the areas at F = 25. Films from denatured or partly digested proteins give large amounts of pressure-sol. components, and by observing time changes in (F, a) curves the mol. wts. of the degradation products range from 1000 to 2000. A general theory of pressure-solubility is given and tested by studies of monolayers of aërosols. W. R. A.

Study of the structure of amorphous films by a new electron diffraction method. I. Saturated aqueous solution of zinc chloride. S. Yamaguchi (*Sci. Pap. Inst. Phys. Chem. Res. Tokyo*, 1940, **38**, 12—14).—Details are given of results recorded previously (A., 1940, I, 410). J. W. S.

Experimental investigation of laminar systems. Formation of thin films of sulphides of zinc and arsenic on the surface of solutions of zinc and arsenic salts. S. G. Mokruschin and R. B. Ginsburg (*Kolloid. Shurn.*, 1939, **5**, 817—822).—5% or 12% H_2S gas diffusing through cotton wool to the surface of a $Zn(OAc)_2$ or $AsCl_3$ solution produced films of ZnS or As_2S_3. The ZnS films reached the final thickness in about 5 min.; this thickness had a max. (about 100 A.) in $1N$-$Zn(OAc)_2$. The As_2S_3 films reached the final thickness in 15 min. or more; this increased with concn. to about 3000 A. The As_2S_3 films appear to be a coagulated sol. J. J. B.

Equilibrium problems in aërosols. I. D. Gurevitsch and V. I. Kapustina (*Kolloid. Shurn.*, 1939, **5**, 781—795).—Aërosols were prepared in an atm. of a known R.H. and then sucked through sintered glass filters; the concn. of the liquid kept back by the filters was determined. For H_2SO_4

and for NH_4Cl obtained by sublimation this concn. is that which would be in equilibrium with the R.H. at the moment of formation of the aërosol. For H_3PO_4 the observed concn. is > the equilibrium concn. by 10—50%; for NH_4Cl prepared from NH_3 and HCl gases the observed concn. is several times < the equilibrium concn. The NH_4Cl solution probably contained free HCl; the discrepancy for H_3PO_4 presumably was also due to a deviation of the composition from that denoted by the formula. J. J. B.

Factors in the stabilisation of emulsions. A. King and G. W. Wrzeszinski (*J.C.S.*, 1940, 1513—1521).—The effects of electrolytes on the cataphoretic velocities and stabilities of oil-in-H_2O emulsions stabilised by various agents have been studied. Al and Th sulphates at certain concns. reverse the charge of emulsions stabilised by saponin or by Daxad agents, but not of those stabilised by aged $Al(OH)_3$ or Na oleate. The effects of a given concn. of electrolyte decrease in the order $Al_2(SO_4)_3$ > $Th(SO_4)_2$ > $MgSO_4$ and H_2SO_4 > K_2SO_4 > KOH. The position of the anion in the lyotropic series is of little importance for its effect on the ζ-potential. The electrical charge is not the main condition for stability. Experiments on the behaviour of conc. oil-in-H_2O emulsions stabilised by different agents when treated with salts having anions representative of the two ends of the lyotropic series, and on the effect of these on solutions or dispersions of the emulsifying agents, show that the strength of the adsorbed interfacial film is the main factor in stabilisation. F. J. G.

Properties of polymerides in solution. XVI. Statistical interpretation of the thermodynamic properties of binary liquid systems. K. H. Meyer (*Helv. Chim. Acta*, 1940, **23**, 1063—1070).—The departure of the entropy of mixtures containing chain-mols. from the ideal val. is considered theoretically. J. W. S.

Dispersoid and high-molecular systems. A. V. Dumanski (*Kolloid. Shurn.*, 1939, **5**, 585—604).—The difference between lyophobic sols, lyophilic sols, and solutions of heavy mols. is discussed. There is an interfacial tension at the micelle/solvent boundary but none at the surface of mols. Large mols. may bind H_2O through their whole vol., not only on the surface. Swelling, viscosity, or osmotic behaviour does not give correct vals. for the bound H_2O. J. J. B.

General law of liquid friction and application to calculation of resistance to motion of disperse systems under isothermal and non-isothermal conditions. I. Connexion between equations of Newton, Maxwell, and Bingham. A. K. Skrjabin (*Kolloid. Shurn.*, 1939, **5**, 363—372).—From a mathematical investigation of the relations between these equations it is suggested that liquids may be classified as (i) Newtonian liquids, with $\eta \neq 0$ and the time of relaxation, t, and the initial val. of the modulus of elasticity, θ_0, both zero, (ii) intermediate liquids, with $\eta \neq 0$, $\theta_0 = 0$, and $t \neq 0$, and (iii) Bingham liquids, with $\eta \neq 0$, $\theta_0 \neq 0$, and $t = \infty$. A generalised law of liquid friction is derived and used to obtain equations for the rates of flow of the various types of liquid through tubes. R. C.

Suspension of solids in mixed liquids. E. W. J. Mardles (*Trans. Faraday Soc.*, 1940, **36**, 1189—1198).—Viscosities at high rates of shear and sediment vols. were measured for suspensions of kaolin and other solids in EtOH–Et_2O, EtOH–H_2O, PrOH–H_2O, MeOH–AcOH, NH_2Ph–AcOH, NH_2Ph–AcOH, oleic acid, and CH_2Ph·OH–*cyclo*hexanone mixtures. The property–composition curves generally present max. or min. Formation of mol. complexes between the liquids often corresponds with a decrease in dispersive action, shown by max. in the η and sediment vol. curves. Thixotropy and high η shown by suspensions in single non-polar liquids are considerably reduced by the addition of a small proportion of a polar substance such as oleic acid or linseed oil, or of a colloidal material, such as cellulose nitrate, that is adsorbed by the solid. F. L. U.

Synthesis of hydrosols of sparingly soluble salts by electrolytic method. Lead chromate hydrosols. B. G. Zaprometov, A. I. Kozirev, and A. A. Melnik (*Kolloid. Shurn.*, 1939, **5**, 441—448).—The conditions for the prep. of positive and negative $PbCrO_4$ sols by the electrolytic method (A., 1934, 1305) have been worked out and the effects of protective colloids examined. R. C.

Bound water in iron and aluminium hydroxide sols. E. Schuruigina (*Kolloid. Shurn.*, 1936, **2**, 55—60).—$Fe(OH)_3$ and

$Al(OH)_3$ sols are shown by refractometric and viscometric studies to be hydrophilic. The amount of bound H_2O decreases on ageing or at higher temp. The results are used to explain the similarity of the hydrophilic properties of the Russian " red " and " black " soils, in spite of large differences in humic acid content.   CH. ABS. (e)

Effect of organic compounds on structure formation in sesquioxide sols. I. Effect of tanning substances. II. Effect of proteins and amino-acids. E. I. Kviat (*Kolloid. Shurn.*, 1939, **5**, 399—408, 449—460).—I. Tannin, gallic acid, and to a smaller extent pyrogallol and quinol have a sensitising action on $Fe(OH)_3$ and $Al(OH)_3$ sols, as indicated by measurements of coagulation threshold and η, and by potentiometric titration. Resorcinol, PhOH, glucose, and mannitol have little effect, whilst BzOH and salicylic acid stabilise at low concns., but sensitise at higher concns. Sensitisation is accompanied by a fall in p_H and is ascribed to complex formation with ions determining the ζ-potential and concurrent displacement of H'; there is no attack on the interior of the micelles, apparently because the complexes formed are insol., and protect the surface of the micelles.

II. Ovalbumin (**I**), peptone, and alanine (**II**) also form complexes in the above way. (**II**) forms, however, a sol. complex, and therefore complex formation is not restricted to ions on the surface of the micelles, but penetrates within, leading to disaggregation of the micelles and therefore to stabilisation of the sol. Acidification of the medium increases the amount of ionic Fe able to participate in complex formation. (**I**) induces intense coagulative structure formation, or even gelation, but after a time there is spontaneous peptisation of such coagulative structures, caused by NH_2-acids formed by hydrolysis of (**I**).   R. C.

Measurement of opacity during the coagulation of concentrated sols of zirconium and stannic hydroxides and the gelation of stannic phosphate and zirconium hydroxide gel-forming mixtures. M. Prasad and K. V. Modak (*Proc. Indian Acad. Sci.*, 1940, **12**, A, 235—244).—Opacity changes occurring when $Zr(OH)_4$ is coagulated by KCl and $Sn(OH)_4$ is coagulated by KCl and by $HgCl_2$ at 33° have been followed by a photo-cell method. Both give S-shaped curves with KCl and with higher concn. of KCl the opacity increases suddenly in the early stages of coagulation. In the coagulation of $Sn(OH)_4$ by $HgCl_2$ the initial opacity decreases rapidly to a min. val. and then slowly rises. S-shaped opacity curves are also obtained for the gelation of Sn^{IV} phosphate (**I**) and show that the gelation process is autocatalytic. The influence of the amounts of $SnCl_4$ and H_3PO_4 in the gel-forming mixtures has been investigated. The opacity-time curves are not influenced by the incident light. $Zr(OH)_4$ gels give similar opacity-time curves to (**I**) gels. There appears to be no distinct difference between the processes of gelation and coagulation.   W. R. A.

Stabilisation of suspensions by fractions of gelatin and agar. P. M. Lapin and S. M. Liepatov (*Kolloid Shurn.*, 1939, **5**, 683—690).—From gelatin and agar fractions were prepared which differed in their tendency to gelate. Fractions gelating easily, especially those prepared by dry heating, reduced the rate of sedimentation of ZnO suspensions more than other fractions; their adsorption, and heat of adsorption, on ZnO powder were also higher. A theoretical explanation of this behaviour is given.   J. J. B.

Stabilisation of sols of iron phosphate by blood serum. M. Kolomijtzeva (*Kolloid. Shurn.*, 1938, **4**, 201—204).—The stabilising effect on Fe phosphate sols of cow's blood serum exceeds that of bull's; this difference does not hold for serum-albumin obtained by dialysis of the sera.   R. T.

Stabilising and protective action of ferric and aluminium hydroxide sols on suspensions of positively and negatively charged particles. G. V. Zacharova (*Kolloid. Shurn.*, 1938, **4**, 191—199).—Aq. suspensions of Fe_2O_3, Al_2O_3, kaolin, MnO_2, talc, S, and chalcedony are stabilised by $Fe(OH)_3$ or $Al(OH)_3$ sols, to an extent $\propto$ their concns., up to a limiting val. The sols also protect the suspensions from sedimentation in presence of electrolytes ($BaCl_2$, NaCl, Na_2SO_4). The effects are ascribed to adsorption of hydrosol particles on those of the suspension, irrespective of the charge of the latter.   R. T.

Changes in the aggregation equivalent A **and the chloro-aggregation equivalent** B **of ferric hydroxide sols with dilution.**

E. I. Kviat (*Kolloid. Shurn.*, 1938, **4**, 217—229).—The equiv. conductivity of $Fe(OH)_3$ sols rises with dilution; this effect diminishes with increasing thoroughness of dialysis of the sols. It is ascribed to dissociation of HCl in the intermicellar fluid, as well as to dissociation of micelles with liberation of Cl'. The dimensions and mobility of the micelles are not affected by dilution.   R. T.

Lyotropic effect of ions on structure formation in ferric hydroxide sols. N. P. Kovalevskaja (*Kolloid. Shurn.*, 1938, **4**, 209—216).—Development of structural η in $Fe(OH)_3$ sols depends on presence of ions, the effectiveness of which rises in the series $Br < NO_3 < Cl$, and $K < Na < Mg$. The effect is ascribed to micellar dehydration, as well as to modification of ζ-potential.   R. T.

Properties of clay suspensions. G. D. Hobson (*J. Inst. Petroleum*, 1940, **26**, 533—564; cf. B., 1935, 630).—Force-flow diagrams are given for a no. of clay suspensions and muds in capillary tubes. The effects on the viscosity of concn., heating, ageing, and mixing samples of different characteristics are recorded and discussed. At high vol. concns. all the suspensions show an increase of η at low rates of flow; one type of clay gives a sigmoid curve in which η increases with increasing rate of flow for intermediate vals. of the latter. In no case does η change with concn. in accordance with Einstein's formula or that of Bingham and Durham (cf. A., 1911, ii, 968); the behaviour of some is represented approx. by the expression $F_S = F_{H_2O}a^{99c/(1-c)}$, in which F_S is the fluidity $(1/\eta)$ of the suspension, c the vol. fraction of solid, and a a const. Concentric cylinder viscometers are not satisfactory for examining clay suspensions, since in η determinations sedimentation is greatly increased by the rotation, and slipping of the cylinder often occurs during the measurement of yield vals. The latter may be determined satisfactorily by using vanes in place of the inner cylinder. An attempt to estimate the amount of H_2O " bound " by various clays is described.   F. L. U.

Effect of the granulometric composition of powders on their ability to bind liquids. I, II. J. M. Gurevitsch and M. T. Bereshinskaja (*Kolloid. Shurn.*, 1939, **5**, 807—816, 823—829).—I. Ultramarine (**I**), rouge (**II**), and Cr_2O_3 (**III**) were each separated into 4 size fractions of 1—2, 2—5, 5—10, and 10—20 μ. The sedimentation vol. of (**I**) and (**III**) in H_2O and linseed oil increased, whilst that of (**II**) in all liquids and of (**I**) and (**III**) in xylene decreased, with diameter. The amount of H_2O, oil, or xylene necessary to form a putty increased with diameter for (**I**) and (**III**), and decreased for (**II**). The viscosity of suspensions of (**I**), (**II**), and (**III**) in paraffin oil, and of (**II**) in linseed oil decreased, and that of (**I**) and (**III**) in linseed oil increased, with diameter. Presumably (**II**) immobilises at its surface more liquid than (**I**) and (**III**) do, whilst in suspensions of (**I**) and (**III**) the liquid is trapped between the particles.

II. Mixtures of particles of different sizes were prepared in various ratios. The amount of linseed oil required to produce a putty with (**I**) increased with the average diameter; it was almost independent of diameter for (**II**) and (**III**). The η of linseed oil suspensions was additive for (**II**) but not for (**I**) and (**III**).   J. J. B.

Silicic acid gels. X. Time of set of gel mixtures containing high concentrations of mineral acids. C. B. Hurd and R. W. Barclay (*J. Physical Chem.*, 1940, **44**, 847—851).—The time of set (t) of SiO_2 gels in presence of HCl or H_2SO_4 increases with increase in p_H over the range 0·5 to $-0·5$, the plot of p_H against log t being linear. This behaviour is opposite to that observed over the p_H range 3—6. p_H change causes greater changes in t for gels containing HCl than for those containing H_2SO_4. The energies of activation, 11,000 and 9000 g.-cal. for the two acids respectively, are lower than those observed for the p_H range 3—6.   C. R. H.

Silicic acid gels. XII. Time of set of acidic and basic mixtures containing phosphoric acid. C. B. Hurd and A. J. Marotta (*J. Amer. Chem. Soc.*, 1940, **62**, 2767—2770).—The effects of temp. and p_H on the time (t) of set of silicic acid (**I**) mixtures prepared from solutions of Na silicate and H_3PO_4 have been studied. Curves of log t against p_H at 0° to 49° show linear variation with a flat min. at the neutral point. In acidic mixtures the p_H increases until the gel sets whilst in the basic range the p_H remains const. before and after setting and from this, the calc. activation energy from p_H 9·0 to 10·5 is ~24,700 g.-cal. With increasing p_H t decreases in the acidic

but increases in the basic range. The results were more in accord with the condensation theory than with the coagulation theory for formation of (I) gels. It is concluded that (I) is stronger than has been previously believed.   W. R. A.

Surface solubility of clay particles. V. S. Scharov (*Kolloid. Shurn.*, 1939, **5**, 571—583).—Behaviour of slurries of clay and H_2O and the electrochemical reactions of clay particles are interpreted in terms of surface solubility.   J. J. B.

Influence of the p_H of the solution on swelling of clay. A. S. Korshuev and Z. L. Borisova (*Kolloid. Shurn.*, 1939, **5**, 667—672).—Swelling of various clays in HCl, NaOAc, buffers, and NaOH was measured. Most clays showed max. swelling in 10N-HCl but kaolin had a max. at p_H 14.   J. J. B.

Proof of the thermodynamic stability of materials taken up by solutions containing solubilisers such as soap. J. W. McBain and J. J. O'Connor (*J. Amer. Chem. Soc.*, 1940, **62**, 2855—2859).—Formation of colloidal solutions of otherwise insol. materials in detergents is accompanied by diminution of free energy and thus the solutions are thermodynamically stable. The v.p. of an insol. volatile liquid taken into colloidal solution by a solubiliser is $\ll$ that of the liquid alone until the solution is approx. saturated. Hydrocarbons, *e.g.*, methyl-*cyclo*pentane, dissolve in aq. K oleate and in soap solutions containing small amounts of silicate or hydroxide. This solubility is not emulsification, protective action, or true dissolution, but must involve some kind of association with dissolved detergent.   W. R. A.

Solubilising and detergent action in non-ionising solvents. J. W. McBain, R. C. Merrill, jun., and J. R. Vinograd (*J. Amer. Chem. Soc.*, 1940, **62**, 2880—2881).—Many solubilisers (detergents) which operate in H_2O (cf. preceding abstract) are equally effective in other solvents in which they are sol. This has been tested by adding dyes to $\sim 1\%$ solutions of detergents. The dyes are not dissolved as single mols. and it would appear that association between dye and detergent occurs. A large no. of systems are qualitatively discussed.   W. R. A.

Physical chemistry of resin solutions. See B., 1941, II, 18.

Colloid-chemical properties of starch. A. M. Schkodin (*Kolloid. Shurn.*, 1939, **5**, 411—417).—The size-distribution curves of various types of potato starch have been determined. Electrolytes accelerate the settling of starch suspensions by coagulative action, apparently through reduction of the H_2O envelopes of the grains. The ζ-potential of starch in H_2O and in aq. solutions of electrolytes has been measured. Starch is negatively charged relatively to H_2O, but addition of sufficient $FeCl_3$ reverses the sign of the charge. The rate of sedimentation increases with fall in the ζ-potential.   R. C.

Determination of capillary-condensed water in hydrophilic colloids. M. V. Tschapek (*Kolloid. Shurn.*, 1938, **4**, 123—130).—The amount of H_2O adsorbed from aq. EtOH by a given wt. of dry starch or agar does not vary with the [EtOH] from 1 to 70%; that sorbed from air varies according to the R.H. of the latter, being $<$ from 70% EtOH at R.H. < 0.7. At R.H. > 0.7, the H_2O bound by the colloids consists of both adsorbed and capillary-condensed H_2O. The amount of the latter is derived from the increase in [H_2O] of 70% EtOH after immersion therein of the given colloid.   R. T.

Electrical volume effects on gels and sols of agar. M. S. Schulman and A. M. Karelschtadt (*Kolloid. Shurn.*, 1939, **5**, 741—748).—By partial dissolution in H_2O agar was separated into three fractions. Their viscosity in H_2O was the higher the less was the solubility. KCl and especially $BaCl_2$ reduced the viscosity. Swelling of agar was reduced by electrodialysis, by KCl, and by $BaCl_2$.   J. J. B.

Influence of sugars, alcohols, anions of organic acids, and of p_H on the rigidity of agar gels. P. S. Shelezkov (*Kolloid. Shurn.*, 1939, **5**, 733—740).—Additions increase the rigidity of 0.5—0.75% agar gels. For 10% additions the increase is 18% for EtOH, 16% for glycerol, 10% for glucose, and 9% for sucrose. In 0.1N. solutions it is 4% for NaOAc, 13% for Na malate, 14% for Na tartrate, and 16% for Na citrate. In presence of citric acid the rigidity has a max. at p_H 3.6. Heating for 20 min. at 75° in presence of 0.2% of citric acid reduces the rigidity; this reduction is smaller when EtOH, glycerol, glucose, or sucrose is added.   J. J. B.

Relation of freezing to concentration of agar gels. P. S. Shelezkov (*Kolloid. Shurn.*, 1939, **5**, 409—410).—The amount

w, of H_2O separating when a gel of concn. c chilled at a given temp. is allowed to thaw is given by $w = ak^{-c}$, where a and k are consts. depending on the experimental conditions and the variety of agar.   R. C.

Mechanism of swelling in cellulose. G. S. Kasbekar (*Current Sci.*, 1940, **9**, 411—413).—Swelling of cellulose in aq. $ZnCl_2$, $Ca(CNS)_2$, $Zn(CNS)_2$, HCl, HNO_3, H_2SO_4, and H_3PO_4 has been investigated. In dil. solution a preferential absorption of solute is observed until the concn. of the solution reaches vals. which cause high swelling. Further, a distinct preferential absorption of salt cations occurs both at low concns. and in the initial stages of swelling at high concns. The formation of hydrocellulose during swelling has been detected. These results indicate the formation of a cellulose-salt or –acid complex which causes the swelling of the cellulose and then its degradation. It is considered that (i) the cellulose mol. combines with the electrolyte to give an oxonium salt, addition occurring at the O bridge linking, (ii) ionisation then occurs giving rise to a diffusible and a non-diffusible ion which causes swelling, and (iii) the non-diffusible ion then reacts with H_2O and, simultaneously, the O bridge is severed leading to the degradation of the cellulose. The proposed mechanism accounts also for hydrolysis by acid or salt catalysis and the observed decrease in ζ-potential with time in acid and salt solutions (cf. A., 1928, 713).   W. R. A.

Theory of nitration of cellulose. S. N. Danilov, V. M. Matveev, and V. I. Buchgalter (*J. Gen. Chem. Russ.*, 1940, **10**, 527—549).—The system HNO_3–H_3PO_4–H_2O consists of anhyd. HNO_3 and hydrated H_3PO_4 when $[H_3PO_4]/[H_2O] \not> 2$, and of N_2O_3, anhyd. HNO_3, and hydrated H_3PO_4 when this ratio approaches 10. No evidence of formation of compounds between H_3PO_4 and HNO_3 is afforded by the v.p.–, conductivity–, or η-composition diagrams. The N content of nitrated cellulose varies roughly parallel with the v.p. of the nitration mixtures. In the system HNO_3–H_2SO_4–H_2O formation of N_2O_3 commences when the ratio $[H_2SO_4]/[H_2O]$ is > 1. The N content of the nitration product varies almost exactly parallel with the v.p. of the nitration mixtures. Conductivity and η are max. for $1 : 1 : 1$ H_2SO_4–H_2O–HNO_3 mixtures. The NO_3 content of cellulose nitrate depends to some extent on the degree of swelling of the cellulose in the given nitration mixture, for which reasons nitration is less complete in totally anhyd. systems than in those of a low H_2O content.   R. T.

Structure and solvation of cellulose nitrate particles. G. V. Liepatova and S. M. Liepatov (*Kolloid. Shurn.*, 1939, **5**, 647—654).—Different fractions of cellulose nitrate (I) have in C_6H_6 and $PhNO_2$ different temp. coeffs. of viscosity; this shows that rise of temp. causes breakdown of micelles as distinct from a reduction of solvation. The ratio of the viscosities of two fractions of (I) is independent of the solvent ($COMe_2$, MeOH, $PhNO_2$) for fractions giving low vals. of η; these fractions may be really dissolved. For other fractions this ratio varies from solvent to solvent, showing the presence of micelles.   J. J. B.

Nature of solutions of lyophilic colloids. S. M. Liepatov (*Kolloid. Shurn.*, 1939, **5**, 613—638).—Systems like gelatin in H_2O or cellulose nitrate in $COMe_2$ are sols as distinct from solutions. Their colloidal nature is demonstrated by the following facts. (1) The activation energy of the swelling of gelatin is endothermic although the process of solvate formation is exothermic. (2) Dissolution of gelatin produced by long heating is not reversible; low-mol. fractions formed during heating protect high-mol. ones. (3) Gelatin sols age to sols having structure, then to gels, and in gels syneresis takes place. Kruyt's theory of solvation does not account for this change since it fails to discriminate between internal and external solvation. Adsorption of low-mol. fractions can stop the ageing. (4) The size of micelles varies with the solvent; solvation alone cannot explain the different effect of solvents on viscosity and osmotic pressure of sols.
   J. J. B.

Solvation of proteins in aqueous solutions of weak acids and bases. I. Interaction of casein with aqueous solutions of acetic, lactic, and citric acids. V. A. Vilenski and A. J. Korolev (*Kolloid. Shurn.*, 1939, **5**, 843—849).—Casein sols were separated from acid solutions by a collodion membrane. The total concn. of the acid was determined before the experiment and after equilibrium was reached, and the p_H of the casein and of the acid solutions was measured. From these data the adsorption by casein of undissociated acid is

calc. In most cases it is $>$ the amount of acid anion bound by casein cations.   J. J. B.

Physico-chemical properties of the outer surface of protein fibres, in connexion with the affinity for water of their interior. V. A. Ptschelin (*Kolloid. Shurn.*, 1938, **4**, 241—248).—The affinity for H_2O of the outer layer of various materials varies in the order cellulose $>$ collagen $>$ hoof keratin $=$ silk $>$ hair $=$ feather. For the inner mass the order is filter-paper $<$ cotton-wool $<$ silk $<$ hoof keratin $<$ wool $<$ feather keratin $<$ rabbit's hair $<$ collagen $<$ mole's hair.   R. T.

Anomalous dispersion as a method of investigating colloidal systems. A. V. Dumanski and M. S. Barvinok (*Kolloid. Shurn.*, 1939, **5**, 639—645).—The radius of protein micelles, supposed spherical, may be calc. from the dispersion of the dielectric const.   J. J. B.

Thermal denaturation of proteins. R. V. Rishova (*Kolloid. Shurn.*, 1938, **4**, 149—155).—The heat of sorption of water and the sorptive capacity of native serum-globulin exceed those of the heat-coagulated product. Thermal denaturation consists in desorption of a thermostable, sol. fraction of high NH_2-content, with micellar aggregation and desolvation of the thermolabile fraction.   R. T.

Physical chemistry of thermal denaturation of proteins. I. Interaction of denatured and native ovalbumin with hydrogen and hydroxyl ions. A. P. Saltschinkin (*Kolloid. Shurn.*, 1939, **5**, 467—473).—From measurements of the fixation of HCl from aq. solution it is found that the electrochemical equiv. is reduced by denaturation.   R. C.

Colloid-chemical hydrolysis of proteins. III. S. I. Djatschkovski (*Kolloid. Shurn.*, 1939, **5**, 501—515).—The Et_2O and C_6H_6 fractions of ovalbumin and casein extracted by emulsification have been examined analytically. The cyclic and aliphatic constituents of the proteins are distributed fairly uniformly between both fractions, but the carbohydrate components such as diglucosamine are to be found in the Et_2O fraction. Conductometric titration indicates that both fractions are richer in basic NH_2-groups than are the original proteins, and measurement of the hydration shows that they are also enriched in hydrated constituents of the proteins. It is inferred that in the adsorption in Et_2O on the Et_2O emulsification the micelles turn their hydrocarbon radicals towards the Et_2O and their NH_2-groups towards the H_2O. A method of determining the H_2O of hydration of proteins is described depending on the observation that on drying at a rising temp. the rate of loss of H_2O increases suddenly when H_2O of hydration begins to be lost.   R. C.

Dielectric constant of fractions of lyophilic colloids. I. Dielectric constant of gelatin fractions. S. M. Liepatov and M. S. Schulman (*Kolloid. Shurn.*, 1939, **5**, 555—566).—Freshly prepared solutions of the fractions have the same dielectric const., ϵ, irrespective of the degree of aggregation, suggesting that association is effected through non-polar groups, a theory also supported by measurement of the effect of temp. on ϵ. For highly polymerised fractions ϵ falls with increasing age by an amount which increases with the concn., but for the thermolysed fraction ϵ is not affected by age.   R. C.

Determination of diffusion coefficient of electrolytes into gels from electrical conductivity measurements. N. F. Jermolenko and S. Levina (*Kolloid. Shurn.*, 1939, **5**, 483—491).—The diffusion coeff. for the diffusion of KCl from $0.1N.$ aq. solution into 5% gelatin gel approximates to the val. for diffusion into H_2O. A new method of determining diffusion coeffs. is described.   R. C.

Swelling and fractionation of elastic gels. A. V. Dumanski and M. S. Barvinok (*Kolloid. Shurn.*, 1938, **4**, 181—190).—The quotient v/Q is const., where v is the increase in vol. of a gel following immersion in H_2O, and Q is the heat effect. Gelatin and starch are separated into more and less sol. fractions (the former by fractional pptn. with EtOH, and the latter by electrodialysis). The swelling capacity of the more sol. fractions is $\gg$ that of the less sol. ones, and that of the latter is greatly augmented by presence of the former.   R. T.

Laminar systems. Electrophoresis of thin films of metal sulphides and metal hydrates on surfaces of water and solutions. S. G. Mokruschin and Z. G. Scheina (*Kolloid Shurn.*, 1939, **5**, 707—715).—Movement of broken films on a H_2O surface between Pt electrodes was observed. Fresh films of

CuS and well washed films of $Al(OH)_3$, $Fe(OH)_3$, $Zn(OH)_2$, and $Cu(OH)_2$ move to the cathode. Films of As_2S_3, Sb_2S_3, Bi_2S_3, PbS, ZnS, and Ag_2S, and fresh films of hydroxides move to the anode. The rate of movement decreases when the film islets remain on the surface. Particles of paraffin wax are negative.   J. J. B.

Electrophoretic study of proteins of egg white. L. G. Longsworth, R. K. Cannan, and D. A. Macinnes (*J. Amer. Chem. Soc.*, 1940, **62**, 2580—2590).—Electrophoretic patterns of egg white and its known components, obtained by the "schlieren" scanning method and an improved electrophoresis cell over p_H 3—8 at ionic strength 0.1, show in egg white the presence of 7 electrically distinguishable constituents, viz., ovalbumin A_1 and A_2, ovomucoid O, conalbumin C_1, and globulins G_1, G_2, G_3. Methods of obtaining and purifying the known components are discussed. Ovalbumin consists of two constituents both in egg white and in the pure state. Each step in its separation has been followed electrophoretically and indicates the greater efficiency of crystallisation over salting out. Isolation of conalbumin involved a form C_2 which slowly reverted above p_H 4 to the normal form C_1 found in egg white. Ovomucoid was not electrically separable into $>$ one form but showed complexity as indicated by "reversible boundary spreading." A quant. analysis of the composition of egg white by the electrophoretic method is given. The mobilities of the components over the p_H range 3·9—8 at 0° and ionic strength 0.1 are tabulated. Evidence is given for protein–protein complexes especially when the components carry opposite electrical charges, the extent of this association increasing with protein concn. and decreasing ionic strength.   W. R. A.

Effect of p_H on sedimentation of clays. A. S. Korshuev and Z. L. Borisova (*Kolloid. Shurn.*, 1939, **5**, 475—482).—The pptn. of a clay suspension may take the form of either rapid formation of a ppt. which subsequently increases in vol. owing to gradual coagulation of the disperse part, or of simultaneous pptn. of the whole mass including the disperse part. The effect of the p_H on the pptn. is most marked over the ranges 0·1—2 and 13—14. At p_H 13 the dispersion is almost stabilised.   R. C.

Methods of producing periodical structures and determining periodicity constant. F. M. Schemjakin and P. F. Michalev (*Kolloid. Shurn.*, 1939, **5**, 655—658).—The paper of Nikiforov and Runtzo (cf. A., 1937, I, 314) is discussed.   J. J. B.
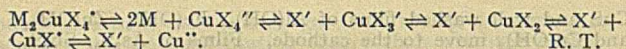
Rhythmic precipitates. I. Electrical study. A. Yanagihara (*Bull. Inst. Phys. Chem. Res. Japan*, 1940, **19**, 1251—1260).—The variation of the e.m.f. of an ion concn. cell, comprising two Pt electrodes inserted into a gelatin gel in which rhythmic pptn. of Ag_2CrO_4 is occurring, has been measured with a quadrant electrometer. The effects of change in the concn. of the inner electrolyte, interchange of the inner and outer electrolyte, and the diffusion of the outer electrolyte into a gel containing no inner electrolyte have been investigated.   J. W. S.

Limits of periodic stratification. S. S. Charamonenko (*Kolloid. Shurn.*, 1938, **4**, 235—239).—The no. of rings forming when aq. $AgNO_3$ is placed on gelatin containing $K_2Cr_2O_7$, or aq. $Pb(NO_3)_2$ on agar containing KI, is limited, being a function of the mol. wt. of the external electrolyte. Knowing this, the no. of rings forming can be predicted, and, conversely, the mol. wt. can be deduced from the no. of rings formed.   R. T.

Influence of hydrolysis of gelatin on periodic reactions. S. S. Charamonenko (*Kolloid. Shurn.*, 1939, **5**, 755—759).—Periodic pptn. of $Ag_2Cr_2O_7$ was produced in 3% gel made from gelatin which had previously been boiled for 1, 2, etc. hr. The product of the rate of diffusion and the average distance between bands increased with the time of boiling. Its magnitude may be used for estimating the degree of hydrolysis of gelatin.   J. J. B.

VI.—KINETIC THEORY. THERMODYNAMICS.

Complex halides of copper and bismuth. A. K. Babko (*Bull. Sci. Univ. Kiev*, 1939, No. 4, 81—105).—Potentiometric measurements in the systems H_2O–KCl–CuX_2 and –BiX_3 suggest the formation of complexes of the types M_2CuX_4 and $MBiX_4$ (X = Cl, Br), dissociating as follows :

$$M_2CuX_4'' \rightleftharpoons 2M + CuX_4'' \rightleftharpoons X' + CuX_3' \rightleftharpoons X' + CuX_2 \rightleftharpoons X' + CuX' \rightleftharpoons X' + Cu''.$$ R. T.

Cryoscopic study of solutions of electrolytes in presence of non-electrolytes. P. Z. Fischer (*Bull. Sci. Univ. Kiev*, 1939, No. 4, 115—120).—Complexes of the type [K, non-electrolyte]Cl(NO₃) appear to exist in solutions of KCl or KNO_3 in aq. $CO(NH_2)_2$, mannitol, or sucrose.   R. T.

Dissociation constants, activation energies, and resonance. H. O. Jenkins (*J.C.S.*, 1940, 1447—1453).—The dissociation consts. of monocarboxylic acids and bases, and also the activation energies for the acid hydrolysis of the chloroacetic esters, are discussed with reference to the resonance energies of the ions. The resonance energies are taken to be $\propto n - 1$, where n is the no. of canonical states, and linear relationships between $\log K$ and $\log n$, and between E and n, are indicated.   F. J. G.

Sugar alcohols. XXI. Effect of the anhydrides of sorbitol on the dissociation constant of boric acid. F. K. Bell, C. J. Carr, and J. C. Krantz, jun. (*J. Physical Chem.*, 1940, **44**, 862—865).—The titration curves of H_3BO_3 in presence of sorbitol are similar to those in presence of mannitol and dulcitol. The curves for the *iso*sorbide (I)– and *iso*mannide (II)–H_3BO_3 complexes coincide with those for the *iso*mannide– and dulcitan–H_3BO_3 complexes respectively. This suggests that (I) has a 1 : 4 : 3 : 6-dianhydro- and (II) a 1 : 4-anhydro-structure. A few conductivity measurements are recorded.   C. R. H.

Dissociation constant measurements on unstable substances. G. Schwarzenbach and K. Lutz (*Helv. Chim. Acta*, 1940, **23**, 1147—1162).—An apparatus which permits the determination of the p_H of solutions containing unstable ions is described. The solutions giving rise to the unstable product flow continuously from separate reservoirs and are mixed in a stream of H_2O immediately prior to passing through the glass electrode. Known concns. of Cl' and I', respectively, in the two reservoir vessels permit the calculation of the composition of the mixture from potentiometric titration of the solution issuing from the glass electrode. The method has been applied to the determination of the dissociation consts. of the enolic forms of CH_2Ac_2, dihydroresorcinol, glutaconic dialdehyde, CHAc₃, the base hydrochloride, $C_{11}H_{13}N_2,HCl$, of Thiele and Steimmig (A., 1907, i, 352), and trimethylpyroxonium perchlorate.   J. W. S.

Dissociation constant measurements on mesomeric acids and bases. Resonance energy. G. Schwarzenbach and K. Lutz (*Helv. Chim. Acta*, 1940, **23**, 1162—1190).—The dissociation consts. of a no. of mesomeric compounds have been determined by potentiometric measurements, and together with previous data are discussed from the viewpoint of resonance effects in the mols. and ions (cf. A., 1939, I, 263).   J. W. S.

Variation of dissociation constants with temperature. G. Schwarzenbach, H. Suter, and K. Lutz (*Helv. Chim. Acta*, 1940, **23**, 1191—1197).—The dissociation consts. (*K*) of CH_2Ac_2 and dihydroresorcinol (I) have been measured at 20—60°. As with other acids *K* passes through a max., but in the case of (I) the const. *f* in Harned and Embree's equation (A., 1934, 732) has a normal val. (∼5 × 10⁻⁵), whereas with CH_2Ac_2 it is 14 × 10⁻⁵, indicating a more rapid decrease in the heat of dissociation with rise of temp. This is ascribed to changes in resonance energy.   J. W. S.

Effects of certain salts on the dissociation of alanine. II. Cells without liquid-junction potentials. A. C. Batchelder and C. L. A. Schmidt (*J. Physical Chem.*, 1940, **44**, 880—892).—The effect of KCl, NaCl, LiCl, and $BaCl_2$ on the dissociation of alanine in acid and alkaline solutions has been investigated and compared with the effects deduced from theoretical considerations. The data recorded supersede those given by earlier experiments in which liquid junctions were present (cf. A., 1940, I, 116).   C. R. H.

Effects of certain salts on the dissociation of aspartic acid, arginine, and ornithine. A. C. Batchelder and C. L. A. Schmidt (*J. Physical Chem.*, 1940, **44**, 893—909).—The investigation described in the preceding abstract has been extended to aspartic acid (I), arginine, and ornithine (II). The dissociation curves of alanine, (I), and (II) in NaCl solutions have been calc.   C. R. H.

Activity of the constituents in mixtures of *n*-butyl alcohol and water at 30°. M. Randall and H. P. Weber (*J. Physical*

Chem., 1940, **44**, 917—920).—The partial v.p. and activities of the constituents in the mixtures are tabulated.   C. R. H.

Electrolyte activities in aqueous solutions. E. Güntelberg (*Kem. Maanedebl.*, 1938, **19**, 85—91; *Chem. Zentr.*, 1938, ii, 3519).—" Apparent " and " real " activity coeffs. of ions in aq. solution are distinguished and discussed. An expression derived for the activity coeffs. in mixed solutions (cf. also Guggenheim, A., 1935, 446) is not in accurate agreement with e.m.f. data for reversible cells containing mixtures of aq. $PbCl_2$ and HCl, LiCl, NaCl, or KCl.   A. J. E. W.

Equilibria in the systems $Na_2O–SiO_2–H_2O$ and $Na_2O–Al_2O_3–H_2O$ at 25°. J. W. Sprauer and D. W. Pearce (*J. Physical Chem.*, 1940, **44**, 909—916).—Data for the system $Na_2O–Al_2O_3–H_2O$ at 25° confirm those of other investigators at 30° after allowing for the difference in temp. Harman's data for the system $Na_2O–SiO_2–H_2O$ (cf. A., 1927, 519) are not confirmed, the field of stability of $Na_2O,SiO_2,6H_2O$ being at lower [Na_2O] than recorded by Harman. Evidence for the existence of $3Na_2O,2SiO_2,11(?)H_2O$ and possibly lower hydrates is presented.   C. R. H.

Solid solutions of picromerites at 25°. A. E. Hill, G. C. Soth, and J. E. Ricci (*J. Amer. Chem. Soc.*, 1940, **62**, 2717—2723; cf. A., 1940, I, 257, 323).—The following systems have been investigated at 25° : $Mg(NH_4)_2(CrO_4)_2–Mg(NH_4)_2(SO_4)_2–H_2O$; $Mg(NH_4)_2(SO_4)_2–Mg(NH_4)_2(SeO_4)_2–H_2O$; $Mg(NH_4)_2(CrO_4)_2–Mg(NH_4)_2(SeO_4)_2–H_2O$; $Mg(NH_4)_2(SeO_4)_2–MgK_2(SeO_4)_2–H_2O$. The pairs of picromerites are completely miscible in the solid states. The systems $MgCrO_4–(NH_4)_2CrO_4–H_2O$ and $MgSeO_4–K_2SeO_4–H_2O$ have also been investigated at 25°.   W. R. A.

Phase behaviour in the methane–propane–*n*-pentane system. R. T. Carter, B. H. Sage, and W. N. Lacey (*Amer. Inst. Min. Met. Eng., Tech. Publ.* 1250, 8 pp.; *Petrol. Tech.*, 1940, **3**, No. 4).—The mol. compositions of the system $CH_4–C_3H_8–n-C_5H_{12}$ at 37·8° and at abs. pressures of 200, 500, 1000, 1500, and 2000 lb. per sq. in. are depicted in triangular diagrams. Equilibrium consts. for the components and the compositions of both phases have been evaluated for all pressures except the lowest.   C. R. H.

Condensation of vapour mixtures containing any number of constituents. V. Fischer (*Ann. Physik*, 1940, [v], **37**, 63—68).—Expressions are derived by which the progress of condensation of a mixture in a countercurrent condenser may be determined from the conditions for liquid–vapour equilibrium. The method is applied to $n-C_5H_{12}–n-C_4H_{10}–C_3H_8–C_2H_6$ and $n-C_5H_{12}–n-C_4H_{10}–C_3H_8–C_2H_6–H_2$ mixtures, for which $K–T$ diagrams due to Souders, Selheimer, and Brown (A., 1932, 696) are employed.   A. J. E. W.

Heats of dilution of aqueous solutions of glycine and glycollamide ; thermodynamic properties of glycine at 25°. F. T. Gucker, jun., H. B. Pickard, and W. L. Ford (*J. Amer. Chem. Soc.*, 1940, **62**, 2698—2704).—The heats of dilution of aq. glycine (3·0—0·005м.) and glycollamide (6·0 and 0·01м.) have been measured at 25°. The relative mol. heat contents (ϕL_2) of each satisfy cubic equations in molality. From heat capacity data cubic equations in temp. are derived for ϕL_2. The osmotic coeff. of glycine and vals. of standard heat, free energy, entropy of formation, and entropy are given for solid and aq. solution at 25° have been calc.   W. R. A.

Comparative energy states of the azulene and naphthalene nuclei. E. Perrottet, W. Taub, and E. Briner (*Helv. Chim. Acta*, 1940, **23**, 1260—1268).—The heats of combustion of guaiazulene (1 : 4-dimethyl-7-*iso*propylazulene) (I) (A., 1936, 993) and cadalene (II) (2 : 5 : 8-$C_{10}H_5Me_3Pr^\beta$) are 2022·9 and 1993·4 kg.-cal. per g.-mol., respectively. From these vals. it is deduced that the heats of formation of (I) and (II) from C and H atoms are 929·3 and 958·8 kg.-cal., respectively, and the corresponding heats of formation of azulene and $C_{10}H_8$ 367·2 and 396·7 kg.-cal., respectively. Hence on passing from $C_{10}H_8$ to azulene the bond energy decreases by 8%, in accord with the greater instability of the azulene nucleus and the strains in the ring systems.   J. W. S.

Entropies of large ions. Heat capacity, entropy, and heat of dissolution of potassium chloroplatinate, tetramethylammonium iodide, and uranyl nitrate hexahydrate. L. V. Coulter, K. S. Pitzer, and W. M. Latimer (*J. Amer. Chem. Soc.*, 1940, **62**, 2845—2851).—Heat capacities have been measured for K_2PtCl_6 (13·70—299·13° к.), NMe_4I (14·10—297·53° к.),

and $UO_2(NO_3)_2,6H_2O$ (13·67—298·68° к.), yielding for $S°_{298·1 к}$, respectively, 79·78±0·4, 49·7±0·2, and 120·85±0·6 g.-cal. per degree per mol. Heats of dissolution are 13,480±150, 10,050±20, and 5250±20 g.-cal., and free energies of dissolution 6970±200, 2340, and −4400±1000 g.-cal., respectively. The partial mol. entropy vals. are respectively 53·2, 50·3, and −17 g.-cal. per degree per mol. The low val. for UO_2·· may be due to H_2O attached to the O of UO_2 by H-bonds or, more probably, to the ion being $U(OH)_4$··. The free energies of formation of $PtCl_6$'' and UO_2·· are −121,500 and −229,200 g.-cal. per mol.

W. R. A.

Thermodynamics and the lowest temperatures. C. G. Darwin (*J. Inst. Elect. Eng.*, 1940, **87**, 581—587).—Kelvin lecture.

VII.—ELECTROCHEMISTRY.

Effect of sorption of water vapour on the conductivity of silica glass. E. V. Ivanova and N. A. Schalberov (*Kolloid. Shurn.*, 1938, **4**, 157—179).—The sp. conductivity of crown SiO_2 glass is $> 10^{-17}$ mho. The surface conductivity, κ, of glass is due to adsorbed moisture, and corresponds with that of a layer of pure H_2O containing some dissolved CO_2, but not containing Na· or K·. The κ of freshly formed glass surfaces (fracture in vac.) varies roughly parallel with the relative humidity of the air to which they are exposed. The vals. of κ for a given surface diminish with repeated successive adsorptions and desorptions of H_2O; this is ascribed to formation of a non-adsorbent surface layer of SiO_2.

R. T.

Conductivity of mixtures of zinc oxide, chromium oxide, and copper. P. Z. Fischer (*Bull. Sci. Univ. Kiev*, 1939, No. 4, 107—113).—Compressed ZnO–Cr_2O_3–Cu mixtures conduct electricity when the Cu content is >70%. The results are not consistent with the view that the oxides are merely inert diluents.

R. T.

Effect of non-electrolytes on (A) hydrogen over-potential, (B) transport number. P. Z. Fischer and T. E. Koval (*Bull. Sci. Univ. Kiev*, 1939, No. 4, 121—136, 137—141).—(A) The H overpotential developed during electrolysis of $2N$-H_2SO_4 is raised by addition of mannitol (I), $CO(NH_2)_2$, glycerol (II), $COMe_2$, or sucrose. This is ascribed to the extra work involved in decomp. of complexes of the type $[H_3O,\text{non-electrolyte}]$·.

(B) The val. of the H· transport no. falls in presence of the above non-electrolytes, except in the cases of (I) and (II). This is in conformity with the view that electrolytic complexes are formed.

R. T.

Vanadium ion oxidation–reduction potentials. A. B. Hart and J. R. Partington (*J.C.S.*, 1940, 1532—1539).—The cells $Pt|VO_2Cl$, $VOCl_2$, $HCl|HCl$, $Hg_2Cl_2|Hg$ and $Pt|(VO_2)_2SO_4$, $VOSO_4$, $H_2SO_4|H_2SO_4$, $Hg_2SO_4|Hg$ have been studied at 25°. The results are consistent with the view that in acid solution V^{IV} and V^V are present as VO·· and VO_2·, respectively, and the standard potentials on the H scale of the HCl and H_2SO_4 cells are 0·9992 and 1·0119 v., respectively. F. J. G.

Relative reducing potentials of starch. R. W. Kerr (*J. Amer. Chem. Soc.*, 1940, **62**, 2735—2738).—Comparison of the relative reducing potentials of 1% solutions of glucose (I), maltose (II), β-amylose (III), and corn starch, and of CH_2O, MeCHO, Pr^{a}CHO, and Bu^{a}CHO supports the view that elementary starch mols. are composed of relatively few glucopyranose units. Application of micro-polarographic methods to (I), (II), and (III) demonstrates that current steps exist for (I) and (II). Evidence is submitted for the possible existence of the carbohydrates in the free aldehydic form which may in turn ionise to acid.

W. R. A.

Photovoltaic behaviour of pure silver bromide. H. L. Sanders and I. M. Kolthoff (*J. Physical Chem.*, 1940, **44**, 936—943).—The changes in potential of a membrane-type AgBr electrode when subjected to illumination have been investigated. The potential becomes less positive on illumination and does not completely return to its original val. Agitation decreases both the photopotential and the recovery time after cutting off illumination. This suggests the presence of a sol. reaction product as a result of illumination. The most probable mechanism seems to be a photodecomp. resulting in a free Br atom and an electron. The latter either reacts to produce Ag atoms or takes its place in the lattice according to the "perforated lattice" theory, but in any case it plays no part in the potential change. The free Br can diffuse into solution giving OBr' and Br' as a result of hydrolysis. As has already been shown (cf. A., 1937, I, 187), Br' make AgBr negative. Positive overpotentials are not observed on account of the absence of free Ag which may be oxidised by Br' or OBr'.

C. R. H.

Hydrogen overvoltage at high current densities. I. Influence of electrode material, current density, and time, in aqueous solution. A. Hickling, and F. W. Salt (*Trans. Faraday Soc.*, 1940, **36**, 1226—1235).—Measurement of the H overvoltage (η) on various electrode materials in N-HCl over a c.d. range of 10^{-3}—1 amp. per sq. cm. by a method previously described (cf. A., 1938, I, 84) shows that Tafel's equation is valid up to the highest c.d. for Bi, Fe, Ni, W, Au, and platinised Pt. With Hg, Cu, C, Cd, Sn, Al, Pt, Rh, and Pb deviations occur and a general tendency for η to become const. at high c.d. is observed. Vals. of b in Tafel's equation found from the η–log c.d. graphs do not generally agree with the val. required by the assumption that overvoltage is due to the slowness of the reaction H· $+ \epsilon \rightarrow H$. Variation of the electrode area does not affect η at const. c.d. The time required for overvoltage equilibrium to be established is markedly reduced by using electrodeposited metals in place of cathodes in massive form.

F. L. U.

VIII.—REACTIONS.

Ignition of inflammable gases by hot moving particles. II. S. Paterson (*Phil. Mag.*, 1940, [vii], **30**, 437—457; cf. A., 1939, I, 475).—Previous experiments are extended to particles moving with lower velocity, 1·2 m. per sec. Ignition temp. T are < those observed at higher velocities but the variation with sphere diameter is similar. No significant effect of mixture concn. was observed for C_5H_{12}–air mixtures ignited by Pt, quartz, and Ni spheres. For a no. of substances, including quartz, Ni, alundum, porcelain, slate, and some metallic oxides and slags, T was independent of the material of the sphere. Polished Pt spheres gave $T \gg$ the other materials. After some use T of the Pt spheres fell to a val. similar to that of the other materials. This change was accompanied by a roughening of the Pt surface. Heating to bright orange in a coal-gas flame restored the polish and the inactivity of the Pt surface. An inactive Pt surface can be activated by heating in air at 1000°. The theories of Silver (A., 1937, I, 247) and Landau (A., 1939, I, 202) are both able to explain the results of the author and others at low speeds but both fail at high speeds where, however, Landau's theory would not be expected to hold.

O. D. S.

Kinetics of thermal decomposition of gaseous silicon tetraethyl and silicon tetrapropyl. C. E. Waring (*Trans. Faraday Soc.*, 1940, **36**, 1142—1153).—The thermal decomp. of $SiEt_4$ and $SiPr_4$ in Pyrex vessels at 500—600° is kinetically complex. The primary process, $SiR_4 = Si + 4R$, is predominantly unimol. and is homogeneous. NO has little or no effect on the primary, but in large amounts markedly inhibits the secondary, process, which is considered to be: $R = C_nH_{2n} + H$, $2H = H_2$ (fast), $C_2H_6 = CH_4 + C$ (slow); and, with $SiPr_4$, $C_3H_6 + 2H = C_2H_4 + CH_4$. Chemical analyses were made over the entire decomp. range.

F. L. U.

Macropolymerisation; mechanism of activation. E. P. Irany (*J. Amer. Chem. Soc.*, 1940, **62**, 2690—2698).—Existing mechanisms of macropolymerisation are discussed. It is considered that the conception of the "opening" of a double bond to produce an activated mol. which initiates chain propagation in both directions is inadequate. Two different types of mesomeric virtual free radicals are postulated: a prototropic type A, which is responsible for the initial activation of the chain process in one direction only, and an addend mol. type B. Macropolymerisation occurs by addition of B to A; A then deactivates and B assumes the protropic form with continuation of propagation. Termination occurs by mutual deactivation of two active chains. B alone can only effect cyclisation. Activation energies of the two types of mesomeric radicals are computed from available data on styrene polymerisation, and hence the reaction consts. of the main phases of the macropolymerisation are calc. The effects of solvents and catalysts are discussed.

W. R. A.

Decomposition of methyl alcohol at high pressures.—See A., 1941, II, 25.

Kinetics of esterification of *cyclo*hexanoic acid and of saponification of its ethyl ester. H. A. Smith and H. S. Levenson (*J. Amer. Chem. Soc.*, 1940, **62**, 2733—2735).—Kinetics of the acid-catalysed esterification of *cyclo*hexanoic acid in dry MeOH at 20°, 30°, 40°, and 50°, and of the saponification of its Et ester in EtOH–H$_2$O (85 : 15) at 35°, 45°, 55°, and 65° have been studied. Kinetically the behaviour resembles that of Pr$^\beta$CO$_2$H but contrasts with that of substituted acetic acids in accord with theory.   W. R. A.

Kinetics of the saponification of esters in dilute solutions. Effect of substitution on the rate-determining factors. H. Shrivastava (*J. Indian Chem. Soc.*, 1940, **17**, 387—394).—A kinetic study of the saponification of eleven aliphatic esters R′CO$_2$R (R′ and R vary from Me to C$_5$H$_{11}$) indicates that velocity changes are primarily due to changes in the steric factor, although for the early members a progressive increase in E in $K = PZe^{-E/RT}$ has a considerable effect. K decreases as the homologous series is ascended and in general E shows a progressive increase. Vals. of K for isomeric *n*-esters are approx. equal, but K for the *iso*-isomeride is $< K$ for the corresponding *n*-isomeride. P is much smaller for esters branched at the α-C than for the *n*-ester.   C. R. H.

Kinetics of mutarotation in solution. J. C. Kendrew and E. A. Moelwyn-Hughes (*Proc. Roy. Soc.*, 1940, **A, 176**, 352—367).—The mutarotation of reducing sugars from the pentose, hexose, and disaccharide series was investigated polarimetrically over a range of temp. in aq. solution. The velocity coeff. is related to the temp. by a modified form of the Arrhenius equation. The significance of the consts. occurring in the equation is discussed in terms of a theory of unimol. reactions in solution.   G. D. P.

Arginase and canavanase.—See A., 1941, III, 136.

Velocity of dissolution of solids. M. Tovbin (*Bull. Sci. Univ. Kiev*, 1939, No. 4, 155—183).—Expressions for the velocity of dissolution of solids are derived, and verified for the cases NaCl and KCl in H$_2$O.   R. T.

Thermal decomposition of nickel formate. A. A. Balandin, E. S. Grigorian, and Z. S. Janischeva (*J. Gen. Chem. Russ.*, 1940, **10**, 1031—1041).—At 250° the reactions Ni + H$_2$ + 2CO$_2$ ← (HCO$_2$)$_2$Ni → Ni + H$_2$O + CO + CO$_2$ proceed simultaneously until about half of the formate has decomposed, after which only the former reaction persists. The activation energy of this reaction is 48·1 kg.-cal. per g.-mol., and the reaction is of the $\frac{2}{3}$ order.   R. T.

Heterogeneous reaction between chromic sulphate and manganese dioxide. M. Prasad and M. A. Naqvi (*J. Indian Chem. Soc.*, 1940, **17**, 370—374).—The reaction between finely-divided hydrated MnO$_2$ and Cr$_2$(SO$_4$)$_3$ solution is initially very rapid but soon slows down. Cr$_2$O$_7$″ formation is increased by increasing [Cr$_2$(SO$_4$)$_3$], by raising the temp., and by decreasing the particle size of MnO$_2$. The reaction is kinetically analogous to the decomp. of NH$_3$ on heated Pt.   C. R. H.

Kinetics of the decomposition reactions of the lower paraffins. VII. Nitric oxide-inhibited decomposition of ethane. E. W. R. Steacie and G. Shane (*Canad. J. Res.*, 1940, **18, B,** 351—357).—The NO-inhibited decomp. of C$_2$H$_6$ has been studied. As the temp. rises from 565° to 640°, the mean apparent chain-length decreases from 5·0 to 2·4. The activation energy of the inhibited reaction is 77·3 kg.-cal. The products are the same as those of the normal reaction. The reaction proceeds mainly by a radical-rearrangement and not by a free radical mechanism.   F. J. G.

Kinetics of the reaction between potassium persulphate and alkyl iodides. III. Catalytic activity of a weak acid. M. S. Telang and V. V. Nadkarny (*J. Indian Chem. Soc.*, 1940, **17**, 381—386).—The catalytic coeffs. of H′, OAc′, and undissociated AcOH have been calc. by three methods from data for the reaction between K$_2$S$_2$O$_8$ and EtI at 50° catalysed by AcOH–NaOAc mixtures. The vals. of the coeffs. obtained by all three methods are of the same order of magnitude. H′ and OAc′ accelerate, and undissociated AcOH retards, the reaction. Addition of KNO$_3$ and NaNO$_3$ to acetate-free AcOH decreases the velocity contrary to the usual " secondary electrolyte effect " for AcOH catalysis.   C. R. H.

Kinetics of the olefine–bromine reaction. I. Dark reaction in acetic acid solution. II. Critical increment of the reaction in acetic acid. S. V. Anantakrishnan and R. Venkataraman (*Proc. Indian Acad. Sci.*, 1940, **12, A**, 290—305, 306—311).—

I. The bromination of crotonic, tiglic, and ββ-dimethylacrylic acids in glacial AcOH has an induction period which varies with temp. and with concn. of reactants, especially [Br′]. The reaction shows several characteristics of a chain reaction involving HBr but a complete mechanism cannot be advanced. The reaction is inhibited by SbBr$_3$ and catalysed by HBr and by ICl. Under controlled catalytic conditions the reaction gives a bimol. coeff. which varies with the nature of the olefine. A " complex " appears to be formed between the olefine and HBr.

II. At higher temp. the induction period in the uncatalysed reaction between an olefinic acid and Br becomes vanishingly small and in the catalysed reaction thermal activation is much more pronounced. Crit. increments are influenced by group and orientation effects.   W. R. A.

Catalytic reduction by means of complex metallic salts. Y. Shibata and T. Yamabe (*Iwata Inst. Plant Biochem.*, 1936, *Publ.* 2, 207—213).—Aq. benzoquinone was reduced by H$_2$ in presence of [Ni(NH$_3$)$_6$]Cl$_2$, [Ni en$_3$]Cl$_2$, [Ni en$_3$]SO$_4$, [Ni en$_3$](NO$_3$)$_2$, and [Ni en(H$_2$O)$_4$]SO$_4$. An initial pressure increase was due to liberation of O$_2$ from a side reaction in which H$_2$O$_2$ was formed. The catalytic activity depended on the structure of the complex, on the anion (SO$_4$″ and Cl′ more effective than NO$_3$′), and on the p_H (optimum 5·5).   Ch. Abs. (*e*)

Catalytic action of complex metallic compounds. Y. Shibata and A. Watanabe (*Iwata Inst. Plant Biochem.*, 1936, *Publ.* 2, 97—128).—Sp. metallic complexes attacked polyphenols or aromatic amines analogously to the substrate specificity of the enzymes. Poisoning of catalytic activity was observed, and addition of colloids increased the oxidising action of the complexes. H$_2$O$_2$ is formed in the oxidising action. Various metal complexes act as do peroxides; the Co^{II} complex and trinitrotriammine-Co oxidised the substrate only in presence of H$_2$O$_2$.   Ch. Abs. (*e*)

Asymmetric oxidation. III. Inhibiting action of some asymmetric organic acids on asymmetric oxidation. Y. Shibata and K. Sakai (*Iwata Inst. Plant Biochem.*, 1936, *Publ.*, 2, 190—200).—Oxidation of pyrocatechol by *d*- (I) and *l*-[Co en$_2$(NH$_3$)Cl]Br$_2$ (II) is retarded by *d*- (III) and *l*-tartaric acid (IV), *l*-cysteine (V), and *d*-bromocamphorsulphonic acid (VI). Combinations (I)–(III), (II)–(IV), (I)–(V), and (II)–(VI) are more effective than combinations of opposite optical activity.   Ch. Abs. (*c*)

Plant proteases. Kinetic properties etc.—See A., 1940, III, 931.

Hydrogenation by means of hydrogen dissolved in palladium. D. P. Dobuitschin and A. V. Frost (*J. Phys. Chem. Russ.*, 1936, **7**, 742—753).—The rate of hydrogenation of C$_2$H$_4$ and C$_4$H$_8$ at −78° by H$_2$ previously adsorbed by Pd was $>$ the rate of desorption of H$_2$, and $>$ the rate of hydrogenation by gaseous H$_2$ at −78° or 20°. C$_2$H$_4$ decreases the rate of adsorption of H$_2$ by Pd.   Ch. Abs. (*e*)

Catalytic addition of hydrogen chloride to ethylene. A. Balandin and O. Livanova (*Utschen. Zapiski*, 1934, **2**, 237—239; *Chem. Zentr.*, 1935, ii, 1528).—Addition (62%) of HCl to C$_2$H$_2$ in presence of BaCl$_2$ was measured by the decrease in pressure. Reaction sets in at 210° but dissociation of EtCl occurs at $>$300°.   Ch. Abs. (*c*)

Nature of surface of catalytic nickel. W. W. Russell and W. V. Loebenstein (*J. Amer. Chem. Soc.*, 1940, **62**, 2573—2580).—Quartz-supported Ni catalysts have been progressively and selectively poisoned by the deposition of C produced by the thermal decomp. of (i) C$_2$H$_4$ at 275° for the hydrogenation of COMe$_2$ at 110°, and (ii) CH$_4$ at 500° for the hydrogenation of CO$_2$ at 315° and N$_2$O at 73·5°. The flow method of measurement has been employed. Catalysts which no longer catalyse the thermal decomp. reactions were still active at lower temp. for the hydrogenation reactions. In the hydrogenation of COMe$_2$ certain parts of the surface are more active than others. The surface responsible for $\sim\frac{2}{3}$ of the hydrogenation of CO$_2$ could be poisoned without affecting that part which catalysed the hydrogenation of N$_2$O. Heating of a surface on which hydrogenation of N$_2$O had occurred caused selective activation or poisoning according to the conditions employed. It is concluded that the surfaces of the catalysts used are not uniform.   W. R. A.

Relative life periods of ethyl alcohol and acetaldehyde molecules on the surface of a copper catalyst. A. Balandin

and A. Bork (*Utschen. Zapiski*, 1934, **2**, 217—220).—The dehydrogenation velocity of EtOH in presence of MeCHO on a Cu catalyst was measured. The MeCHO mol. remains on the catalyst surface 5 times as long at 270°, and 3 times as long at 240°, as does the EtOH mol. Сн. Abs. (*e*)

Orientation of molecules of secondary alcohols during dehydrogenation catalysis. A. Balandin, M. Maruschkin, and B. I. Konnikov (*Utschen. Zapiski*, 1934, **2**, 221—224).—The rates of dehydrogenation of PrβOH and *cyclo*hexanol at 230—270° on Cu were the same. Both mols. are attracted to the Cu surface by the OH·CH< group. Сн. Abs. (*e*)

Activation energy in heterogeneous catalysis. G. Rienäcker [with H. Wittneben and H. Bade] (*Z. Elektrochem.*, 1940, **46**, 369—373).—Activation energies (*A*) of the decomp. of HCO$_2$H vapour at 150—220° in contact with Bi in different states of subdivision vary from 11·6 kg.-cal. for fine (<0·5 mm.) powder to 24·0 kg.-cal. for single crystals. *A* is greatly increased if the powdered Bi is previously tempered 8 days at 250°. In the same reaction catalysed by Ni the val. of *A* is greatly increased by previous rolling of the metal. From a comparison of the decomp. of HCO$_2$H and the hydrogenation of C$_2$H$_4$ on various compact metal catalysts no relation of activity to other properties of the metal is observable.
F. L. U.

[Catalytic] **preparation of oxalic acid** [from sucrose].—See B., 1941, II, 1.

Catalytic hydrogenation of petroleum fructions.—See B., 1941, I, 11.

Catalytic action of Japanese acid clays on mixtures of aniline and methyl alcohol vapours.—See A., 1941, II, 38.

Kinetics of reactions in the zinc–hydrogen irreversible cell. J. I. Jolley and H. V. Tartar (*Trans. Electrochem. Soc.*, 1940, **78**, *Preprint* 10, 139—159).—Apparatus for the determination of the rate of reaction between Zn and acid, the metal being the anode of a Zn–H$_2$ irreversible cell, is described. The effect of the composition of the electrolyte, of rotation of the electrode, of temp., and of the resistance of the cell on the kinetics of the dissolution of Zn in various dil. acids has been investigated, and the similarity between the behaviour of the Zn–H$_2$ cell and of local galvanic couples is demonstrated. The rate of dissolution of Zn in acid is inversely $\propto$ the resistance of the electrolyte, to the resistance of the external circuit between the anode and cathode, and to some function of the acid concn.
J. W. C.

Electrolytic deposition of soft γ-manganese. E. Herrmann (*Ann. Physik*, 1940, [v], **37**, 155—161).—Soft γ-Mn is deposited on a continuously wiped Al cathode of special design (c.d. 0·2 amp. per sq. cm.) in stirred aq. MnCl$_2$ and NH$_4$Cl ($p_H \sim 7$) (cf. Brunke, A., 1935, 19), at 30°. The Pt anode, in saturated aq. NH$_4$Cl, is isolated in a porous cylinder wrapped in Cellophane; Cl$_2$ is led away from the anode surface through tubes. Brittleness of samples obtained previously is attributed to slight oxidation of the Mn solutions. The γ-Mn oxidises very rapidly on exposure to air unless passivated by dipping in aq. Na$_2$Cr$_2$O$_7$. A. J. E. W.

Reducibility of quadrivalent zirconium. A. W. Laubengayer and R. B. Eaton (*J. Amer. Chem. Soc.*, 1940, 62, 2704—2706).—From studies of the cathode processes involved in electrolysis of solutions of ZrCl$_4$ (0·169, 0·383, and 0·544M.) in HCl (6—8N.) only H$_2$ is produced and Zr'''' is not reduced. Polarographic examination of solutions of ZrOCl$_2$ (0·01 and 0·001M.) at various p_H vals. (0·1M-KCl as indifferent electrolyte) indicates the existence of at least one, and sometimes two, reduction steps, the first due to H$_2$ discharge and the second at ~1·69 v. to reduction to Zr. The potential at which Zr is deposited varies with p_H. W. R. A.

Anodically oxidised coatings on aluminium.—See B., 1941, I, 37, 38.

Chemical action of electrical discharges. XX. Conditions for obtaining high energy yields in the synthesis of hydrogen cyanide by means of the electric arc. E. Briner and H. Hoefer (*Helv. Chim. Acta*, 1940, **23**, 1054—1062; cf. A., 1938, I, 150, 407).—The effects of pressure, relative concns., and the frequency of the discharge on the yield of HCN obtained by the action of an electric arc on mixtures of N$_2$ with CH$_4$, C$_4$H$_{10}$, n-C$_6$H$_{14}$, or n- or *iso*-C$_8$H$_{18}$ have been investigated. By using low pressures and an excess of N$_2$ the deposition of soot can be avoided without the addition of H$_2$. Under optimum conditions of pressure and concn. the yields of HCN are 60, 80, 100, and 120 g. per kw.-hr. with CH$_4$, C$_4$H$_{10}$, C$_6$H$_{14}$, and C$_8$H$_{18}$, respectively. With C$_8$H$_{18}$–N$_2$ mixtures the [HCN] reaches 5%. J. W. S.

Free radicals in the process of pyrolysis and in the electrical discharge.—See A., 1941, II, 25.

Bromine-sensitised photodecomposition of ozone. R. Mungen and J. W. T. Spinks (*Canad. J. Res.*, 1940, **18**, **B**, 363—371; cf. A., 1931, 1250).—The Br-sensitised photodecomp. of O$_3$ has been studied at 0—30° and atm. pressure, using light of λ 5460, 3650, and 2537 A. The quantum yield is ~25—30 for λ 5460 and 3650 A., and is independent of [O$_3$]. For λ 2537 A. the quantum yield is much smaller. The temp. coeff. for λ 5460 A. is 1·01 for 10°. At —40°, in light but not in the dark, a Br oxide, probably Br$_3$O$_8$, is deposited on the walls, suggesting that the reaction involves the formation and decomp. of unstable Br oxides. A scheme is proposed, involving BrO$_2$ and BrO$_3$, and beginning with dissociation of Br$_2$ for the longer λλ, and of O$_3$ for λ 2537 A.
F. J. G.

Photochemical reduction of ferric iron by oxalic acid. (Miss) G. Kornfeld (*J. Physical Chem.*, 1940, **44**, 949).—In support of Livingston's conclusions (cf. A., 1940, I, 327) experiments which show that the reaction velocity $\propto$ light intensity, and that the reaction proceeds to the end regardless of the presence of Fe'', are mentioned. C. R. H.

Thermal decomposition of benzoyl peroxide. D. J. Brown (*J. Amer. Chem. Soc.*, 1940, **62**, 2657—2659).—Calc. amounts of Bz$_2$O$_2$ (**I**) were diluted with C$_6$H$_6$ to a definite vol. and kept at 80°. At regular intervals samples were withdrawn, cooled rapidly to 20°, and undecomposed (**I**) was determined iodometrically. The initial velocities for the concn. range 0·025—0·80M-(**I**) have been measured. The decomp. velocity increases from zero to a max. and then satisfies the requirements of simultaneous occurrence of uni- and bi-mol. reactions. The decomp. is accelerated by light but is unaffected by surfaces. The products of the unimol. reaction are chiefly Ph$_2$ and CO$_2$, whilst the principal product of the bimol. reaction is BzOH. A mechanism is advanced. W. R. A.

Photochemical transformation of *trans*- into *cis*-di-*p*-toluoylethylene. W. H. Martin, H. D. Bett, R. G. Romans, and W. Tidridge (*Trans. Roy. Soc. Canada*, 1940, [iii], **34**, III, 35—41).—The quantum yield for the isomerisation of *trans*- (**I**) to *cis*-di-*p*-toluoylethylene under the influence of light of λ 4047 A. in COMe$_2$ at 35° is 0·45, suggesting that the equivalence law holds for the loosening of the double bond, and that there is a slightly greater chance of recombination to form (**I**), corresponding with its greater thermodynamical stability. F. J. G.

Heat of photobromination of phenylmethanes and cinnamic acid, and the influence of oxygen. J. L. Magee and F. Daniels (*J. Amer. Chem. Soc.*, 1940, **62**, 2825—2833).—Photokinetics of Br substitution and addition at 25°, in the presence and absence of O$_2$, of CCl$_4$ solutions of CHPh$_3$, CH$_2$Ph$_2$, PhMe, and cinnamic acid (**I**) have been studied using calorimetric measurements and 4360 A. At [Br] 0·002 mol. per l., light intensity 500 ergs per sec., and with almost complete removal of O$_2$, the quantum yields (ϕ) were 1000, 250, 50, and 35 mols. per quantum respectively; ϕ increases with [Br]. Heats of bromination in the absence of O$_2$ were 15, 12, 8, and 18 kg.-cal. per mol., respectively. All the brominations were chain reactions and all were inhibited by O$_2$, the inhibition being greatest for PhMe and (**I**) and least for CHPh$_3$. The larger evolution of heat in the presence of O$_2$ indicates that an oxidation process takes place during the inhibition reactions and is explained as a competing reaction between O$_2$ and the free radicals which propagate the chain. W. R. A.

Oxygen inhibition in photobromination of cinnamic acid. R. F. Brown and F. Daniels (*J. Amer. Chem. Soc.*, 1940, **62**, 2820—2825).—Photobromination of cinnamic acid (**I**) at 25°, 35°, and 45° and of CHPh$_3$, stilbene, and CHPh:CPh$_2$ at 35° in the presence and absence of O$_2$ has been studied. Approx. vals. of quantum yields (ϕ) are given. O$_2$ and traces of quinol greatly reduce ϕ, whilst H$_2$O vapour and BzO$_2$H have little effect. Although a large consumption of O$_2$ was observed during the bromination of (**I**) no peroxide formation could be detected. The effect of O$_2$ is attributed to competing reactions involving bromoperoxycinnamic acid free radicals, whilst in the absence of O$_2$ chains are thought to be pro-

pagated by bromocinnamic acid free radicals. The temp. coeff. was ~ 1 in the absence of O_2 and >1 when O_2 was present. W. R. A.

Quantum yields of some dye-sensitised photo-oxidations. F. Hurd and R. Livingston (*J. Physical Chem.*, 1940, **44**, 865—873).—Quantum yields of the photo-oxidation of I', S_2O_3'', and allylthiocarbamide by several dyes have been determined. Similar experiments on the photo-oxidation of $H_2C_2O_4$ show this to be negligible. The data are compared with those of other investigators. C. R. H.

Quantum yield as function of wave-length for inactivation of urease.—See A., 1940, III, 931.

IX.—METHODS OF PREPARATION.

Preparation of ortho-deuterium. L. Farkas and L. Sandler (*J. Amer. Chem. Soc.*, 1940, **62**, 2877—2878).—The *p–o* conversion of D_2 has been carried out by adiabatic desorption of H_2 from charcoal pre-cooled by solid air in an apparatus which is described. W. R. A.

Preparation of "absolute water" with the "Allassions." R. Loosjes and W. R. Domingo (*Chem. Weekblad*, 1939, **36**, 835—836).—H_2O equal to distilled H_2O in quality can be obtained by treating tap-H_2O with ion-exchange agents (Allassion-*C* and -*A*) and finally with $Na_2Al_2O_4$ to remove SiO_2. The cost of chemicals for regenerating the adsorbents is a fraction of that for distillation. (Cf. A., 1938, I, 153.) S. C.

Oxygen exchange between water and inorganic oxy-anions. G. A. Mills (*J. Amer. Chem. Soc.*, 1940, **62**, 2833—2838).— A known wt. of inorg. salt was dissolved in a definite amount of H_2O having ^{18}O fraction of 86×10^{-5} (ordinary H_2O has ^{18}O fraction of 200×10^{-5}) and maintained at const. temp. for a certain time, after which the water was distilled off in a vacuum and analysed for ^{18}O. Pyrex glass and a strongly alkaline solution gave no exchange at 110°. At 19·3° there was complete exchange between CrO_3 and H_2O in 1·5 hr. With Na_2CrO_4 and H_2O at 19·3° complete exchange did not occur until 96 hr. but at 70° and 110° the time was 2 hr. and 3 hr., respectively. Na_2CrO_4–H_2O–NaOH gave no exchange at 19·3°, partial exchange at 70° after 2 hr., and approx. complete exchange at 110° after 3 hr. $KHSO_4$–H_2O exhibited partial exchange at 100°, whereas no exchange could be effected with K_2SO_3–H_2O or with Na amalgam–H_2O. On the other hand, $Na_2S_2O_5$–H_2O showed partial exchange after 1 hr. at 19·3°. $K_2S_2O_3$–H_2O showed no exchange at 19·3° after 2 hr. but partial exchange after 2 hr. and complete exchange after 24 hr. at 100°; when NaOH was added no exchange, at 100° for 4 hr., occurred. $KMnO_4$ and H_2O at 100° exchange ^{18}O partly after 1 hr. and completely after 24 hr. The exchange may take place in three ways: (i) direct interchange of O atoms, (ii) addition and subsequent removal of H_2O or OH' to the anion with possible exchange, and (iii) formation of undissociated acid by hydrolysis, followed by reversible anhydride formation. The last accounts satisfactorily for experimental data. In all cases the rate of O exchange is related to the acid strength of the corresponding acid. W. R. A.

Spontaneous decomposition of sodium hypochlorite. J. M. A. y Iníguez (*Rev. univ. Zaragoza*, 1936, 65 pp.).—In alkaline solutions NaOCl decomposes little in the absence of O_2. In strongly alkaline solutions mutual oxidation of OCl' ions occurs. In slightly alkaline solutions OCl' is oxidised by HOCl. This reaction is catalysed by Cl'. CH. ABS. (*e*)

Interaction between potassium metaperiodate and the soluble salts of metals of alkaline earths. R. K. Bahl and M. Lal (*J. Indian Chem. Soc.*, 1940, **17**, 395—396).—When a hot solution of KIO_4 is added to a boiling solution of $CaCl_2$, $SrCl_2$, or $BaCl_2$, $Ca_2I_2O_9,8H_2O$, $Sr_2I_2O_9,8H_2O$, and $Ba_2I_2O_9,4H_2O$, respectively, are pptd. C. R. H.

Production of beryllium compounds free from iron.—See B., 1941, I, 65.

Electron diffraction study of the surface of magnesium attacked by an aqueous chloride solution. S. Yamaguchi (*Nature*, 1940, **146**, 654).—In the first stage of corrosion by Cl' the Mg is covered first by a black and then by a white porous substance. Electron diffraction shows that both substances consist of crystals of $Mg(OH)_2$ and MgO. The surface film that protects Mg from the action of H_2O consists of a mixture of cryst. $Mg(OH)_2$ and MgO. Cl' thus catalyses the reaction between Mg and H_2O. L. S. T.

Action of chlorine on the hydroxides of alkaline earths in presence of iodine. II. R. K. Bahl and S. Singh (*J. Indian Chem. Soc.*, 1940, **17**, 397—399).—When Cl_2 is passed through hot solutions of $Ba(OH)_2$ or $Sr(OH)_2$ or suspensions of $Ca(OH)_2$ containing dissolved I, $Ba(IO_3)_2,H_2O$, $Sr(IO_3)_2,H_2O$, and $Ca(IO_3)_2,6H_2O$, respectively, are pptd., and I is liberated. Periodate is not formed. C. R. H.

Effect of carbonate-ion concentration in water softening.— See B., 1941, III, 26.

Illustrations of reactions between solids. H. S. van Klooster (*J. Chem. Educ.*, 1940, **17**, 361—363).—Reactions in mixtures of PbS and $CdSO_4$, K_2S and $CdSO_4$, $PbCl_2$ and KI, $HgCl_2$ and KI, $CoSO_4$ and NaCl, BaS and $ZnSO_4$, and BaS and $CdSO_4$ are discussed. L. S. T.

Dissolution and precipitation of lead and zinc sulphides in sodium sulphide solutions. F. G. Smith (*Econ. Geol.*, 1940, **35**, 646—658).—Amorphous ZnS and PbS dissolve to a limited extent in aq. Na_2S_{n+1} and NaSH on heating at 415—425° for 2—3 hr. in a C-lined steel bomb. As the solutions cool (18—20 hr.), sphalerite (I) crystallises before galena (II). (I) then redissolves partly, and is deposited later as amorphous ZnS, small crystals of (I), or as wurtzite (III). (II) redissolves to a smaller extent, and is deposited later as microcryst. (II). The redissolution of (I) and (II) is due probably to colloidal dispersion, and the higher is the [S] in the solution the less important are the later colloidal effects. The higher is $[NaHS]/[Na_2S_{n+1}]$, the greater is the tendency for (III) rather than (I) to form from the deposition of ZnS from the colloidal state. Solutions of Na_2S_{n+1} and/or NaSH may be the type of solution active in the transportation of (I) and (II) in nature. L. S. T.

Bleaching of lead pigments darkened by exposure to hydrogen sulphide.—See B., 1941, II, 19.

Effect on lead arsenate of certain salts which may be present in soil and spray waters.—See B., 1941, III, 6.

Nitroxyl perchlorate. W. E. Gordon and J. W. T. Spinks (*Canad. J. Res.*, 1940, **18**, B, 358—362).—*Nitroxyl perchlorate*, $NClO_6$, is obtained by the action of small amounts of ClO_2 on air charged with N oxides and O_3 by an ozoniser. It is a white cryst. substance having a v.p. $< 0·05$ mm. at room temp.; it decomposes at 120°. It is sol. in $POCl_3$, insol. in CCl_4, and reacts violently with most org. liquids. It dissolves in H_2O, affording HNO_3 and $HClO_4$, and it reacts with I on warming, affording I_2O_5 and (probably) ICl. $NClO_6$ is to be regarded as a mixed anhydride of HNO_3 and $HClO_4$. It probably results from direct union of NO_3 and ClO_3, these being formed by the action of O_3 on NO_2 and ClO_2, respectively. F. J. G.

Sulphur iodides. III. Sulphur di-iodide. M. R. A. N. Rao (*J. Mysore Univ.*, 1940, I, 75—82; cf. A., 1940, I, 296).— Treatment of a dil. solution of SCl_2 (in dry CCl_4) with dry KI yields *S di-iodide*, which is brown in dil. solution. In light it decomposes rapidly into S and I. It also decomposes into S and I on contact with H_2O, but with NaOH in the presence of $Cd(OH)_2$ considerable amounts of CdS, Na_2SO_3, $Na_2S_2O_3$, and Na_2SO_4 are also formed, the amount of free S liberated being the less the greater is the [NaOH]. Investigation of the hydrolysis of S_2I_2 in the presence of I, added to the aq. NaOH or to the S_2I_2 in CCl_4 before mixing, indicates that SI_2 may also be formed when I is added to S_2I_2 in CCl_4. J. W. S.

Preparation of chemically pure CrO_3. N. D. Birjukov (*J. Gen. Chem. Russ.*, 1940, **10**, 942—944).—CrO_3 decomposes in hot aq. solution as follows: $2CrO_3 \rightarrow Cr_2O_3 + 3O$; $Cr_2O_3 + 3H_2CrO_4 \rightarrow Cr_2(CrO_4)_3 + 3H_2O$; $Cr_2(CrO_4)_3 \rightarrow Cr_2O_3,3CrO_3$. For this reason CrO_3 cannot be obtained chemically pure by recrystallisation. R. T.

Highly substituted sodium salts of phosphomolybdic acid. E. A. Nikitina (*J. Gen. Chem. Russ.*, 1940, **10**, 997—1006).— Salts of the composition $nNa_2O,P_2O_5,24MoO_3$ ($n = 4$—11) have been prepared by adding the theoretical amount of NaOH to $Na_3[PO_4,Mo_{12}O_{18},36OH]$. $11Na_2O,P_2O_5,24MoO_3$ and aq. NaOH yield Na_2HPO_4 and $5Na_2O,12MoO_3$. The structure of 24-phosphomolybdic acid is discussed in the light of these findings. R. T.

Photochemical preparation of tungsten by cold-reduction of tungstic acid, WO_3.—See B., 1941, I, 36.

X.—ANALYSIS.

Quantitative analysis and the theory of measurement. F. H. Hurley (*J. Chem. Educ.*, 1940, **17**, 334—336).—A discussion.
L. S. T.

Systematic separation of anions. E. Umblia (*Keem. Teated*, 1935, **2**, 79—87).—A scheme for the separation of anions is given.
CH. ABS. (*e*)

Electrochemical determination of iodine. M. Tovbin and M. Feldman (*Bull. Sci. Univ. Kiev*, 1939, No. 4, 185—195).—Small concns. of I (2—10 mg. per l.) are determined by an electrochemical method, depending on the depolarising effect of I during electrolysis with a voltage < that of the decomp. potential.
R. T.

Sodium furoate as preservative [of thiosulphate and starch solutions]. A. M. Platow (*Chemist Analyst*, 1939, **28**, 30—31; *Int. Sugar J.*, 1940, **42**, 69).—N-$Na_2S_2O_3$ to which 0·1% of Na furoate (I) had been added preserved its normality for 3 months. Furoic acid as well as (I) (0·1%) preserved starch solution indefinitely without settling occurring.
J. P. O.

Determination of phosphorus in stainless steels by the rapid "analoid" method.—See B., 1941, I, 33.

Rapid determination of arsenic by distillation.—See B., 1941, I, 36.

Determination of small quantities of carbon dioxide in air by absorption of infra-red radiation. H. Dingle and A. W. Pryce (*Proc. Roy. Soc.*, 1940, **B, 129**, 468—474).—Determination of up to ∼0·2% of CO_2 in air (dried by P_2O_5) is based on the strong absorption band of CO_2 at ∼4·3 μ. The radiation from a Meker burner passes through a stainless-steel tube containing the air and the transmitted radiation is measured by a thermopile; a similarly fitted tube, symmetrically placed on the other side of the burner, forms a balancing control for the galvanometer circuit and the deflexion is calibrated by observations with air of known CO_2 content in one of the tubes.
F. O. H.

Micro-titrimetric determination of carbon dioxide in carbonates. A. F. Colson (*Analyst*, 1940, **65**, 638—643).—A micro-apparatus is described, with reference to a sketch, for determining a few mg. of CO_2 by absorption in NaOH and $BaCl_2$ solution followed by neutralisation to phenolphthalein and acidimetric titration of the $BaCO_3$ ppt. Possible sources of error and means of avoiding them are discussed.
A. R. P.

Microchemical determination of silver for toxicological analysis. S. Wehrli (*Helv. Chim. Acta*, 1940, **23**, 1197—1200). —The org. material is treated with H_2SO_4 and fuming HNO_3, and, after removal of the HNO_3 and most of the H_2SO_4 by heating, the solution is diluted, boiled, and filtered. The filtrate (∼20 c.c.) is treated with $CuSO_4$ (10 mg.) and saturated with H_2S. The ppt. is separated, dissolved in fuming HNO_3, and after dilution is again treated with H_2S. This process is repeated until a clear blue solution is obtained. This solution is then evaporated with H_2SO_4, diluted, and electrolysed in a divided cell, using a Au cathode and 30% H_2SO_4 as anolyte. After prolonged electrolysis at 1·2 v. the Ag is completely deposited on the Au, and can be dissolved in HNO_3. The opalescence obtained on addition of a trace of dil. HCl is observed. The Ag can be re-deposited by electrolysis using a Au cathode and Pt anode after addition of excess of NH_3.
J. W. S.

Electrochemical methods in microchemistry. E. B. Ashcraft (*Trans. Electrochem. Soc.*, 1940, **78**, *Preprint* 9, 127—137).—A review of progress in the electrometric detection of small quantities of Ag, Cu, Zn, As, and other metals, and in the electrolytic determination of Cu, Hg, Ag, Ni, Sn, Zn, etc., and of several acid radicals.
J. W. C.

Assay of zinc stearate ointment.—See B., 1941, III, 21.

Quinaldinic acid as a reagent for the separation of copper and cadmium. A. J. Lindsay and R. J. Shennan (*Analyst*, 1940, **65**, 636—638).—For complete pptn. of Cu by Na quinaldinate (I) in H_2SO_4 solutions of p_H 1·22 a threefold excess of (I) is necessary but complete pptn. is obtained in AcOH solutions of p_H 1·5—6·86. In the presence of Cd the ppt. of Cu compound is always contaminated with Cd under all conditions which ensure complete pptn. of the Cu. Ráy and Bose's method (A., 1934, 270) is therefore untrustworthy.
A. R. P.

Assay of mercuric chloride.—See B., 1941, I, 18.

Determination of mercuramine chloride in ointments.—See B., 1941, III, 20.

Application of base-exchange materials in analytical chemistry. IV. Determination of iron and aluminium in presence of phosphoric acid. O. Samuelson (*Svensk Kem. Tidskr.*, 1940, **52**, 241—247; cf. A., 1940, I, 444).—Fe and Al are removed from the PO_4'''-containing solution by percolating it through a sulphonated organolith, which is washed free from PO_4''' with H_2O, and the metal ions then eluted with dil. HCl and determined in the usual way. Metal–phosphate complexes are decomposed during the percolation and do not cause errors, but PO_3' and P_2O_7'''' should be converted into PO_4''' beforehand.
M. H. M. A.

Cyanometric determination of cobalt and nickel. W. J. Agnew (*Analyst*, 1940, **65**, 643—644).—Evans' method (A., 1937, I, 377) has been modified as follows : the neutral Co + Ni solution containing ⊅0·04 g. of metal is diluted to 150 ml., treated with 10 ml. of 1 : 1 HNO_3 and an excess of standard KCN solution, shaken for 4 min., treated with 20 ml. of 1 : 1 aq. NH_3 and 10 ml. of 4% aq. KI, and titrated as usual with $AgNO_3$. The Ni consumes 4KCN and the Co 6KCN. In a second portion of the original solution the Ni is determined by the glyoxime method after treating the solution as above and destroying the excess of KCN by boiling with ammoniacal H_2O_2 which oxidises the Co to $Co(CN)_6'''$ and destroys the $Ni(CN)_4''$.
A. R. P.

Rapid determination of tungsten in tungsten steels.—See B., 1941, I, 33.

XI.—APPARATUS ETC.

Thermostatic control. C. Butt (*Science*, 1940, **92**, 339—340).—A circuit operated by a.c. is described.
L. S. T.

Air jacket for f.p. apparatus. H. G. Cassidy (*J. Chem. Educ.*, 1940, **17**, 397—398).—Glass tubing closed at one end by a rubber bung forms a strong jacket.
L. S. T.

Barrier-layer resistance of selenium photo-cells. A. E. Sandström (*Phil. Mag.*, 1940, [vii], **30**, 428—429; cf. A., 1940, I, 83).—"Tiring" of photo-elements has now been observed. Increased resistance produced by electric shock has been confirmed. When an illuminated element is restored to darkness the increase in resistance is almost immediate.
O. D. S.

Emission spectrum analysis as a routine quantitative method. Application to the analysis of pure aluminium. A. von Zeerleder and F. Rohner (*Helv. Chim. Acta*, 1940, **23**, 1287—1297).—The apparatus used in the routine determination of Si, Fe, and Cu in Al by emission spectrum analysis is described, and the advantages of this method over chemical methods are discussed.
J. W. S.

Colour control.—See B., 1941, I, 2.

Cathodic rectification of current in zero arm of Nernst bridge. A. G. Sarkisov (*Kolloid. Shurn.*, 1939, **5**, 389—392). —The use of a valve-rectifier in the Nernst bridge for measuring dielectric const. is described.
R. C.

Determination of p_H with the thymoquinhydrone electrode. H. J. C. Tendeloo, J. S. Buy, and J. A. Huyskes (*Landbouwk. Tijds.*, 1938, **50**, 742—746; *Chem. Zentr.*, 1938, ii, 3576).—Thymoquinhydrone (I), a 1 : 1 mol. compound of thymoquinone and -quinol, may be used at p_H ⊅10·5. If the e.m.f. of the (I) cell with a saturated HgCl electrode is E mv., $p_H = (359 − E)/57·7$. At $E = 0$, $p_H = 6·22$.
A. J. E. W.

Improved [electrical] conductivity apparatus. W. S. McGuire (*J. Chem. Educ.*, 1940, **17**, 381—382).
L. S. T.

Vacuum tube oscillator for measuring the conductance of electrolytes. D. E. Hull (*J. Chem. Educ.*, 1940, **17**, 329).
L. S. T.

Apparatus for measuring the dielectric constant of non-conducting liquids. B. E. Hudson and M. E. Hobbs (*J. Chem. Educ.*, 1940, **17**, 366—370).—The method is based on the heterodyne beat principle. Wiring diagrams are reproduced. Performance is illustrated by determinations of μ for $PhNO_2$ in C_6H_6 and of ε for mixtures of Et_2O and $CHCl_3$.
L. S. T.

Projection Wilson chamber. M. B. Holm (*Fys. Tidssk.*, 1938, **36**, 63—67; *Chem. Zentr.*, 1938, ii, 3366—3367).—A radial expansion chamber (Wilson and Wilson, A., 1935,

599) containing a mixture of EtOH and H_2O vapours (1 : 1) is arranged with an arc lamp and condenser to give α-ray track images ∼2 m. in length.　　　　　　　　A. J. E. W.

High-temperature positive-column discharge tubes. R. F. Barrow (*Proc. Physical Soc.*, 1941, **53**, 40—43).—The construction and operation of two tubes for investigating the emission spectra of refractory materials are described. The temp. necessary for developing a convenient v.p. of the material is attained by degradation of part of the energy of the positive column of the discharge which is constricted, in one case, in the narrow central part of an all-SiO_2 tube, and, in the other, by a small axial hole through a sintered Al_2O_3 cylinder, supported centrally in a SiO_2 envelope tube.
　　　　　　　　　　　　　　　　　N. M. B.

Improved pole-piece construction of the objective lens of a magnetic electron microscope. A. Prebus (*Canad. J. Res.*, 1940, **18**, A, 175—177; cf. A., 1939, I, 433).—The use of a thin-walled Fe tube as spacer facilitates construction and allows a higher degree of axial symmetry.　　　F. J. G.

Integrating circuit for vapour-type Geiger–Müller counters. L. F. Curtiss (*J. Res. Nat. Bur. Stand.*, 1940, **25**, 369—377).— A circuit for integrating the pulses from tube counters filled with EtOH vapour and A, and recording them as a steady deflexion on a milliammeter, is described. The pulses are amplified and levelled with a resistance-capacity coupled amplifier, and are then rectified and fed into a condenser with resistance leak. A valve voltmeter measures the voltage of this condenser, which ∝ the counting rate.　　　J. W. S.

Apparatus for study of the physics of the atomic nucleus. R. Schmidt (*Tech. mod.*, 1938, **30**, 585—592; *Chem. Zentr.*, 1938, ii, 3575).—A description of apparatus for the production and use of high voltages in nuclear physics.　　A. J. E. W.

American apparatus, instruments, and instrumentation. R. M. Müller (*Ind. Eng. Chem.* [*Anal.*], 1940, **12**, 571—630). —A review in which developments and modern trends in the following are illustrated : linear and displacement measurements; weighing; time measurements; temp. production, control, and measurement; high vac. and measurement and control of gases; electrical and electronic instruments; optical instruments; glassware; automatic controllers and recorders; instrumental methods of analysis; microchemistry; and general laboratory appliances.　　　L. S. T.

Producing air-vapour mixtures in gas or fume chambers. L. Silverman (*J. Sci. Instr.*, 1940, **11**, 346).—Liquid is introduced into the chamber from a calibrated syringe provided with an electrically heated jet.　　　　　　O. D. S.

Measurement of static and dynamic foams in characteristic units. G. L. Clark and S. Ross (*Ind. Eng. Chem.*, 1940, **32**, 1594—1598).—A static foam meter is described, in which the rate of accumulation of liquid resulting from the collapse of a previously produced foam is measured. The " foaminess," Σ, derived from the known exponential rate of decrease in the no. of bubbles, is expressed in sec. by the formula $\Sigma = t / 2\cdot3 \log [100/(100 - V)]$, where V is the vol. of liquid collected in t sec. from a foam prepared under standard conditions. With ovalbumin dynamic measurements give higher vals. of Σ for CO_2 than for air, whilst the converse is true of static measurements. These foams do not follow a logarithmic law of subsidence, whereas beer foams do so over a considerable range of their lifetime. There is evidence of a reaction between CO_2 and ovalbumin, a solid scum being produced which is not observed when the foam is made with air.　　F. L. U.

Micro-pyknometer. G. Okamoto and M. Shindo (*J. Chem. Soc. Japan*, 1936, **57**, 609—613).—A discussion of the sensitivity of the float for determining the d of D_2O.
　　　　　　　　　　　　　　　　　CH. ABS. (*e*)

Mol. wt. by isothermic distillation. J. B. Niederl and A. M. Levy (*Science*, 1940, **92**, 225—226).—Barger's method (*J.C.S.*, 1904, **85**, 286) is modified so that mixing of the two solutions is prevented by using two capillaries, one for the unknown sample and one for the standard. Differentiation between ±0·01 molarities is possible.　　　L. S. T.

Powder method for measurement of chemical durability of glass.—See B., 1941, I, 23.

Generation of hydrogen sulphide. A. H. Prezioso (*J. Chem. Educ.*, 1940, **17**, 399).—Apparatus for generating H_2S (FeS and HCl) and storing it over H_2O is described and illustrated.
　　　　　　　　　　　　　　　　　L. S. T.

Wash bottle. R. Woodriff (*J. Chem. Educ.*, 1940, **17**, 323). —A wash bottle which enables the amount of wash liquid to be measured and controlled accurately, and is operated by a rubber bulb, is described and illustrated.　　　L. S. T.

Air-driven ultracentrifuge. F. R. Eirich and E. K. Rideal (*Nature*, 1940, **146**, 541—542, 551—552).—Construction and operation of an experimental model are outlined. Performance is illustrated by data recorded for ovalbumin, cytochrome C, a globulin arachin from *Arachis hypogæa*, and carbonic anhydrase. The globulin appears to contain five different groups of mol. wts. dependent on the nature of the salt used to effect dissolution.　　　L. S. T.

Drying apparatus for flasks. F. L. James (*J. Chem. Educ.*, 1940, **17**, 400).—An ordinary hair dryer fitted with a brass reducer and Cu nozzle serves to introduce air into the heated flask.　　　　　　　　　　　　　　　　L. S. T.

Apparatus for rapid determination of arsenic in presence of antimony. V. Biskupski (*Bull. Soc. Chim. Yougoslav.*, 1939, **10**, 75—80).—Distillation is conducted in a stream of HCl at 70—100°, when $AsCl_3$, but not $SbCl_3$, distils over.　　R. T.

Determination of mol. wt. at low pressures by means of V. Meyer's method. D. Milosavlević and M. Jovanović (*Bull. Soc. Chim. Yougoslav.*, 1939, **10**, 57—62).—Meyer's method is adapted for low pressures.　　　　　　　R. T.

Safety valve to prevent return of water in water pumps. S. Ristić (*Bull. Soc. Chim. Yougoslav.*, 1939, **10**, 85—86).—Minor modifications of Fournier's device (A., 1938, I, 278) are proposed.　　　　　　　　　　　　　　R. T.

Use of anhydrite as a desiccating agent. H. Hawley (*Analyst*, 1940, **65**, 644—645).—Anhydrite prepared by dehydrating white gypsum at 230—250° absorbs up to 5% of its wt. of H_2O from the air rapidly and evenly and is a better desiccating agent than $CaCl_2$ for drying gases or use in a desiccator; it can be regenerated many times. It effectively removes H_2O from EtOH, 100 g. being required to bring 100 c.c. from 98% to 99·8% EtOH.　　　A. R. P.

Modified lecture experiment. W. J. Conway (*J. Chem. Educ.*, 1940, **17**, 398).—Directions for demonstrating the law of mass action by means of the liberation of I from KIO_3 and H_2SO_3 are given. The addition of EtOH stabilises the solution of H_2SO_3.　　　　　　　　　　　L. S. T.

[Electrical] conductivity tests for reactions that go to an end. E. L. Gunn (*J. Chem. Educ.*, 1940, **17**, 385—386).— Apparatus for demonstrating the completeness of various ionic reactions is described.　　　　　　　　L. S. T.

Earliest history of capillary chemistry. I. Traube (*J. Chem. Educ.*, 1940, **17**, 324—329).—A review.　　L. S. T.

XIII.—GEOCHEMISTRY.

Charged particles in the dust of the atmosphere at Vesuvius. F. Signore (*Ann. Osservator. Vesuviano*, 1935, [iv], **3**, 17— 44).—The high val. obtained for the charged particles in the air is partly due to the high radioactivity of the Vesuvian lavas.　　　　　　　　　　　　CH. ABS. (*e*)

Analysis and study of hot spring-water in Foochow. T. H. Wang and Y. T. Lin (*Amer. J. Sci.*, 1940, **238**, 799—804).— Ten analyses of H_2O from hot springs and hot H_2O wells are recorded and discussed. The H_2O is of volcanic origin, descending surface H_2O being heated by contact with hot rock masses. One fissure spring has a high F content, and evolves gas, probably N_2.　　　　　　　　L. S. T.

Iron dissolved in the lake waters of Japan. II. S. Yoshimura (*Japan. J. Geol.*, 1936, **13**, 39—56; cf. *ibid.*, 1931, **9**, 61). —Data for the surface waters of 150 Japanese lakes are given.
　　　　　　　　　　　　　　　　　CH. ABS. (*e*)

Bartlett meteorite, Bell Co., Texas. F. M. Bullard (*Amer. Min.*, 1940, **25**, 497—500).—The meteorite is a medium octahedrite composed of kamacite with some taenite, plessite, schreibersite, troilite, and possibly lawrencite. The chemical analysis [F. A. Gonyer] is Fe 90·41, Ni 8·88, Co 0·47, P 0·22, Cu none, Cl trace, S none, Mn none, total 99·98%. The spectrographic analysis [H. A. Wilhelm] shows the presence of Fe, Ni, Co, with traces of Ge, Cu, and Si.　　L. S. T.

Quartz crystal with base from N⁙ St. Vincent. H. Buttgenbach (*Ann. Soc. géol. Belg., Bull.*, 1938, **61**, 325—326; *Chem.*

Zentr., 1938, ii, 3524).—An occurrence of the very rare base, (0001), is reported. A. J. E. W.

Composition and properties of shore and dune sands. W. H. Barrett (*Geol. Mag.*, 1940, **77**, 383—394).—The significance of minor variations in composition and properties of sand samples collected from the neighbourhood of Perranporth, Cornwall, has been investigated. Mechanical and chemical compositions, heavy mineral contents, and measurements of the degree of rounding are recorded and discussed. L. S. T.

Thorium–uranium ratio in rocks and in the sea. H. Petterson [with E. Foeyn, B. Karlik, and E. Rona] (*Anz. Akad. Wiss. Wien, math.-nat. Kl.*, 1937, 127—128 ; *Chem. Zentr.*, 1938, ii, 3382).—Skagerrak sea-H_2O contains 10^{-6} g. of Th and $1\cdot5$—$2\cdot0 \times 10^{-6}$ g. of U per l. ; the Th : U ratio is thus probably $<0\cdot5$. The deficit of Th is due to co-pptn. in sediments, probably with $Fe(OH)_3$; simultaneous pptn. of Io may be the cause of a reduced Ra : U ratio in the H_2O, although pptn. of $RaCO_3$ with $CaCO_3$ in living organisms is also possible. A. J. E. W.

Lattice constants of cerussite. G. A. Lindsay and H. C. Hoyt (*Z. Krist.*, 1938, **100**, 360—362 ; cf. Colby, A., 1933, 215).—A precision X-ray determination, by the Bragg method, of natural face spacings of a specimen from Tsumeb gives the cell elements : $a\ 5\cdot1726$, $b\ 8\cdot4800$, $c\ 6\cdot1302$ A. I. McA.

Origin of the nelsonite dykes of Amherst Co., Virginia. C. H. Moore, jun. (*Econ. Geol.*, 1940, **35**, 629—645).—Rock types are described, and the origin of the nelsonite dykes is discussed. Nelsonite dykes, consisting mainly of ilmenite and apatite, are related genetically to a younger hypersthene granodiorite that invaded the host rock of Lovington gneiss. L. S. T.

Microscopical features of ore from the Sunshine Mine, Idaho. R. J. Anderson (*Econ. Geol.*, 1940, **35**, 659—667).—Tetrahedrite (I) is the Ag-bearing mineral, but as polished surfaces show no Ag minerals in it the Ag is present probably as an isomorphous constituent. Pyrite was the earliest sulphide, followed by arsenopyrite, (I), galena (II), and chalcopyrite. Where (II) is in contact with (I) the development of bournonite is common. Siderite and quartz are the important gangue minerals. L. S. T.

Nature of the ore-forming fluid. E. Ingerson and G. W. Morey (*Econ. Geol.*, 1940, **35**, 772—785).—A discussion of Graton's views (cf. A., 1940, I, 379). L. S. T.

Zinc and lead deposits of Shawangunk Mountain, New York. A. I. Ingham (*Econ. Geol.*, 1940, **35**, 751—760).—Geology, mode of occurrence, and mineralogy are described. The ores were deposited probably by solutions of magmatic origin. L. S. T.

Structure and mineral zoning of the Pailaviri Section, Potosi, Bolivia. D. L. Evans (*Econ. Geol.*, 1940, **35**, 737—750).—Mineralisation has been dependent on structure and zoning, and not on favourable or unfavourable rock types. Three periods of mineralisation are indicated. L. S. T.

Paragenesis in the Hollinger [Porcupine District, Ontario] veins. M. R. Keys (*Econ. Geol.*, 1940, **35**, 611—628).—The minerals of the Au deposits are described, and their paragenesis is discussed. Most of the Au occurs in a quartz–ankerite–pyrite type of ore body, and was introduced later than the major period of quartz mineralisation. In the veins, the Au appears to be related genetically to a pale green sericite ; in the wall rocks, it is associated with, but is probably later than, pyrite. L. S. T.

Albite and gold. D. Gallagher (*Econ. Geol.*, 1940, **35**, 698—736).—A literature review shows that numerous Au deposits from many parts of the world are related genetically to albiterich igneous rocks. These deposits contain little Ag, and the sulphides are simple and not abundant, whereas Au deposits related genetically to K-rich rocks are argentiferous, polymetallic, or contain abundant suphides. The Au deposits cannot be explained by a one-magma theory of petrogenesis ; the granitic and trondhjemitic rock suites with their respective pegmatites and Au deposits are derived from two distinct magma types. L. S. T.

Alaskitic gold vein of the Kinsei Mine, Korea. T. Kato (*Japan. J. Geol.*, 1936, **13**, 103—105).—The deposit is described. The Au content in some parts is 50—80 g. per ton ; a common figure is 10 g. per ton. CH. ABS. (*e*)

Genetic relations of gold deposits and igneous rocks in the Canadian shield. E. S. Moore (*Econ. Geol.*, 1940, **35**, 127—139).—An address in which periods of Au deposition, magmatic sequences, and the rôle of lamprophyres and other basic rocks in ore deposition are discussed. L. S. T.

Bornite–klaprotholite relations at Concepcion del Oro, Mexico. P. Krieger (*Econ. Geol.*, 1940, **35**, 687—697).—The occurrence of klaprotholite (I) in the Cu ore of this district, and its relation to bornite (II), are described. (I) and (II) were probably deposited simultaneously as products of unmixing from a solid solution. L. S. T.

Cordierite–anthophyllite rocks associated with spinel–hypersthenites from Toodyay, W. Australia. R. T. Prider (*Geol. Mag.*, 1940, **77**, 364—382).—The petrography and petrogenesis are described, and 9 chemical analyses are recorded. L. S. T.

Contact metamorphism by a Tertiary dyke at Waterfoot, Co. Antrim. D. L. Reynolds (*Geol. Mag.*, 1940, **77**, 461—469).—Felsitic material, often spherulitic in habit, and resembling felsite resulting from the rapid cooling of acid igneous material, has developed in Triassic pebble beds at their contact with a Tertiary dyke of olivine-dolerite, as a result of potash metasomatism at a temp. high enough for tridymite to form. Chemical analyses [W. H. Herdsman] of two sandstones are recorded. L. S. T.

Geology of Basutoland. G. M. Stockley (*Geol. Mag.*, 1940, **77**, 444—460).—The geological succession and structure, the stratigraphy of the Stormberg sediments, the volcanicity of the Drakensberg beds, and the petrography of the Drakensberg lavas and dolerites are discussed. Chemical analyses of a basalt from the Orange River and one from the Malibamatso River are included. L. S. T.

Magnetite in sulphide ores. G. M. Schwartz and A. C. Ronbeck (*Econ. Geol.*, 1940, **35**, 585—610).—A review of the literature indicates that magnetite (I) occurs in numerous sulphide deposits as an epigenetic mineral. Tabulation of 130 deposits or districts in which (I) occurs shows that the common sulphides, in order of the no. of occurrences, are : chalcopyrite, pyrite (II), pyrrhotite, sphalerite, galena, arsenopyrite, bornite, and chalcocite. Lesser sulphides such as molybdenite, pentlandite, marcasite, cubanite, enargite, tetrahedrite, and covellite occur less commonly. Hæmatite is a common associate of (I) in these deposits. (I) with sulphides occurs in deposits of magmatic, pyrometasomatic, and hypothermal origin ; it is practically absent in other types of deposits. Normally, (I) is the first metallic mineral to form, indicating that, in general, it forms only at high temp. In a few deposits (I) is preceded by (II), or, less commonly, by other sulphides. Once formed, (I) is stable ; it shows only moderate evidence of replacement by later minerals. L. S. T.

Sphalerite and galena in sedimentary rocks in Ohio. K. Ver Steeg (*Science*, 1940, **92**, 259).—Occurrences of these two minerals in association are noted. L. S. T.

New source for agate artifacts in central New Mexico. F. T. McCann (*Science*, 1940, **92**, 259).—Some of the agate artifacts in this area are derived from rock *in situ*, and not from river gravels. Cerro Colorado is such a source. L. S. T.

Geochemistry of quicksilver mineralisation. I, II. R. M. Dreyer (*Econ. Geol.*, 1940, **35**, 17—48, 140—157).—I. Chemical and physical factors that result in the formation of a typical Hg ore, containing cinnabar and possibly Hg and metacinnabar, and the relation of the common Hg and gangue minerals to the mineralising solutions are discussed.

II. Petrographic aspects of the geochemistry of Hg mineralisation are discussed. These include the relation of cinnabar deposition to characteristic types of wall rock alteration, the relation of FeS_2 to HgS mineralisation, and the mode of access of the mineralising solutions into the country rocks. The marked syngenesis of cinnabar with SiO_2 is emphasised. L. S. T.

Geochemistry of quicksilver mineralisation. J. J. Fahey, M. Fleischer, and C. P. Ross (*Econ. Geol.*, 1940, **35**, 465—470).—A criticism of some of Dreyer's conclusions (preceding abstract). L. S. T.

Temperature and depth in hypogene ore deposition. E. Y. Dougherty (*Econ. Geol.*, 1940, **35**, 188—191).—A discussion. L. S. T.

Pegmatites of the Spruce Pine district, N. Carolina. C. S. Maurice (*Econ. Geol.*, 1940, **35**, 158—187; cf. A., 1940, I, 303). L. S. T.

Tridymite. C. Durrell (*Amer. Min.*, 1940, **25**, 501—502).— Tridymite from Plumas Co., California, has α 1·478, β 1·479, γ 1·481 (all ±0·001). L. S. T.

Relation between colloidal character of certain marls and their behaviour in borings and in tectonics. M. Didier and J. Lacoste (*Compt. rend. Soc. géol. France*, 1938, 137—139; *Chem. Zentr.*, 1938, ii, 3383).—Cretaceous marl from Morocco absorbs twice to three times as much H_2O as other marls, and gives a viscous colloidal solution (d 1·2—1·3) which is readily flocculated in sea-H_2O. The marl contains clay with 5·72% of very finely-divided dolomite. The properties given explain its unusual plastic character. A. J. E. W.

Effect of volume constancy of reacting solid components on magmas. P. Michot (*Ann. Soc. géol. Belg., Bull.*, 1938, **61**, 337—339; *Chem. Zentr.*, 1938, ii, 3383).—The composition of a magma after reaction with adjacent rocks differs according as the reactants have const. or variable vol. A. J. E. W.

Decomposition of rocks and ceramic materials with a small amount of sodium carbonate. J. I. Hoffman (*J. Res. Nat. Bur. Stand.*, 1940, **25**, 379—383).—The finely-ground sample (0·5 g.) is mixed with Na_2CO_3 (0·5 g.) in a 75-mm. Pt dish. If Fe^{II} or much Pb is present 0·05 g. of KNO_3 is added. The mixture is spread in a thin layer and covered evenly with Na_2CO_3 (0·5 g.) and heated gradually at first and finally at 1200° during 15 min. After cooling the melt is treated with dil. HCl and evaporated to dryness with this reagent in the usual way. The same Pt vessel is used for ignition of the SiO_2, thereby eliminating the transference of the whole of the ppt. to the filter-paper. Analyses of various types of minerals and refractories using 1 g. and 4—10 g. of Na_2CO_3 are recorded and compared, the smaller amount of Na_2CO_3 being shown to be sufficient under the fusion conditions used. J. W. S.

Bentonite. M. Guédras (*Rev. Fond. mod.*, 1938, **31**, 334—338; **32**, 7—10; *Chem. Zentr.*, 1938, ii, 3588).—The mineralogical composition and structure of bentonites and their behaviour with H_2O are reviewed. Analyses are given, and a classification is proposed. Alkali and alkaline-earth bentonites, which contain readily exchangeable cations but are not decomposed by H_2SO_4, are distinguished. Sub-bentonites also contain exchangeable cations, but their properties are modified by acid. A. J. E. W.

Neptunite crystal. H. Buttgenbach (*Ann. Soc. géol. Belg., Bull.*, 1938, **61**, 324—325; *Chem. Zentr.*, 1938, ii, 3524).— Two new faces, (11.11.10) and ($\bar{2}$1.10.10), have been observed. A. J. E. W.

Dolerites from Portuguese Guinea. E. Polinard (*Ann. Soc. géol. Belg., Bull.*, 1938, **61**, 313—322; *Chem. Zentr.*, 1938, ii, 3524).—A petrographic study. The dolerites, like those from French Guinea, consist chiefly of labradorite and pigeonite. Three types, with different hypersthene, biotite, and olivine contents, are distinguished. Three analyses are given. A. J. E. W.

Determination of the volume percentage of mineral components by means of measurement of the light reflected from a polished section. M. Vendl (*Publ. Dept. Min. Met. Roy. Hung. Palatin-Joseph Univ.*, 1934, **6**, 285—288).—Components of an ore or a coal are determined by utilising the different reflectivity for light of the components. Intensity measurements are made on a polished specimen by means of a photocell. CH. ABS. (*e*)

Distinctive isomerism in synthetic and mineral inorganic compounds. A. Quartaroli and O. Belfiori (*Rend. Seminar. Fac. Sci. R. Univ. Cagliari*, 1937, **7**, 111—142; *Chem. Zentr.*, 1938, ii, 3380—3381).—A discussion of a possible type of isomerism in which like atoms in a compound, although shown to be equiv. chemically; *e.g.*, two forms of $CaHPO_4$, written $Ca_2\{(HPO_4)_2\}$ and $Ca\{Ca(HPO_4)_2\}$, are distinguished. The differences are correlated with observed variations of solubility, action with acids, etc. Other examples considered include $Ca_3(PO_4)_2$, $MgCO_3$, NiS, CoS, CO_2, $COCl_2$, and H_2O. A. J. E. W.

Age of the uraninite from the McLear pegmatite near Richville station, St. Lawrence Co., N.Y. B. M. Shaub (*Amer. Min.*, 1940, **25**, 480—487).—The occurrence of the uraninite

as small cubes in the pegmatite is described, and a chemical analysis [F. Hecht] is recorded. The Pb–U–Th ratio is 0·156, and corresponds with an age of 1094×10^6 years. Pb–U–Th ratios for other areas in Ontario, Quebec, and New York are tabulated and discussed. L. S. T.

Geology of the iron ores of the Collingwood District, N.W. Nelson. M. Gage (*New Zealand J. Sci. Tech.*, 1940, **21**, 304—313B).—The geology of the region, the mode of occurrence of the ore, and the available sources of Fe are described, and the ore-forming processes discussed. The limonitic ores of this district resulted from interaction of pyritic minerals with various forms of calcareous rocks, and by direct oxidation of Fe-rich sedimentary minerals and surface concn. of pyrite from deep-seated sources by percolating H_2O. Eight chemical analyses of associated rocks are recorded. L. S. T.

Crystal chemistry of the phosphates, arsenates, and vanadates of the type $A_2XO_4(Z)$. W. E. Richmond (*Amer. Min.*, 1940, **25**, 441—479).—The phosphates, arsenates, and vanadates of this type are classified on the basis of their chemical and physical properties into two groups of the type $AAXO_4(Z)$ and $ABXO_4(Z)$. The crystallographic and optical properties and the chemical formulæ of the minerals of these groups are tabulated and discussed. X-Ray analyses give the following new vals. for a_0, b_0, c_0 and the space-groups; olivenite, $4[Cu_2AsO_4(OH)]$, 8·16, 8·54, 5·86 A., D_2^{4}—$P2_12_12_1$; higginsite, $4[CuCaAsO_4(OH)]$, 7·42, 9·20, 5·85 A., D_{2h}^{5}—$Pmam$; austinite, $4[CaZnAsO_4(OH)]$, 7·43, 9·00, 5·90 A.; duftite, $4[CuPbAsO_4(OH)]$, 7·50, 9·12, 5·90 A., D_{2h}^{6}—$Pnan$; pyrobelonite, $4[(Mn,Pb)_2VO_4(OH)]$, 7·84, 9·45, 6·09 A., D_{2h}^{16}—$Pnam$; sarkinite, $8[Mn_2AsO_4(OH)]$, 12·71, 6·78, 10·20 A., β 108° 18′, C_{2h}^{5}—$C2_1a$; triplite, $16[(Mn,Fe)_2PO_4(OH)]$, 12·03, 6·46, 10·03 A., β 105° 42′, C_{2h}^{5}—$P2_1/a$; triploidite, $16[(Mn,Fe)_2PO_4(OH)]$, 12·24, 13·35, 9·88 A., β 108° 04′, C_{2h}^{5}—$P2_1/a$; wagnerite, 11·93, 12·47, 9·44 A., β 108° 09′, C_{2h}^{5}—$P2_1/a$; amblygonite, $2[(Li,Na)AlPO_4(F,OH)]$, 4·92, 7·05, 4·93 A., α 107° 22′, β 97° 27′, γ 109° 50′, C_i^{1}—$P\bar{1}$. A new chemical analysis [F. A. Gonyer] of wagnerite from Werfen, Germany, is recorded. L. S. T.

Geochemical prospecting. New method of gas and oil exploration. S. E. Slipper (*Amer. Gas J.*, 1940, **153**, No. 2, 31—33).—Geochemical prospecting for oil is based on the theory that gas seepage from an oil deposit takes place slowly by diffusion through overlying strata. On a geological time scale relatively heavy hydrocarbons can diffuse through long distances in minute quantities. Low-temp. fractional distillation methods of gas analysis have made possible a direct method of prospecting for petroleum. Recent work in this field is reviewed. R. B. C.

Geographical distribution of black soil pigment. W. S. Gillam (*J. Amer. Soc. Agron.*, 1939, **31**, 371—387).—High org. matter contents in soil are not necessarily paralleled by the content of black pigment, *i.e.*, the org. matter peptised by 4% aq. NH_3, pptd. by acids, and insol. in EtOH. The relative proportion of pigment in the org. matter was generally greater in the surface than in the subsurface 6-in. layer. The humus colour (aq. NH_3 extract) of soil extracts was $\propto$ the pigment content. In soils from regions of similar rainfall the org. matter (or humus content)–mean annual temp. relationship is represented by a sigmoid curve. For each fall of 10° in mean annual temp. along isohyetal lines the average org. matter and humus contents were doubled, the relative pigment colour was increased 2—6 times, and the relative humus colour 2—3 times. Equal differences in mean temp. had a greater effect on the relative pigment, org. matter, and humus contents of soil in areas of greater rainfall. With increasing rainfall along an isothermal line the average org. matter, relative humus content, and relative pigment content increased curvilinearly and the relative humus colour linearly. With increasing temp. along isohyets the relative pigment content and relative humus colour increased linearly. Addition of org. materials and their subsequent decomp. over a 62-week period caused no appreciable increase in relative pigment content or relative humus colour. The relative humus content of soil types decreased in the order podsol, grey-brown forest soils, red and yellow soils, chernozems, laterites; the relative pigment content and humus colour decreased in the order chernozems, forest soils, laterite, red and yellow soils. The last-named two types were characterised by fairly high humus but low relative pigment contents. A. G. P.

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