BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

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

AUGUST, 1942.

I.—SUB-ATOMICS.

Radiation from carbon arcs. H. G. MacPherson (*J. Appl. Physics*, 1942, **13**, 97—102).—The radiation characteristics of the low- and high-intensity C arcs and of the flame arc are described, and the processes which determine them are discussed. O. D. S.

Persistent lines in arc spectra. J. M. López de Azcona (*Inst. Geol. Min. España*, 1941, **8**, 171—187).—Lines persisting at 5×10^{-4} to 5×10^{-9} g. for the 70 elements which give arc spectra have been redetermined. F. R. G.

Spectrum analysis. Review of progress.—See A., 1942, I, 247.

Triplets of helium. D. R. Inglis (*Physical Rev.*, 1942, [ii], **61**, 297—302).—The inversion of the He triplets and their deviation from interval rule are due to spin–other-orbit and to spin–spin interactions, respectively. Heisenberg's preliminary calculation is compared with Breit's correct calculation for the lowest triplet (cf. A., 1932, 441). Araki's extension to higher triplets (cf. *Proc. Phys. Math. Soc. Japan*, 1937, **19**, 128) is simplified and generalised, and comparison with experiment is discussed. N. M. B.

Term formulæ for the configuration d^5. O. Laporte (*Physical Rev.*, 1942, [ii], **61**, 302—304).—Formulæ for the case of Russell–Saunders coupling are reported for the first time. Although several terms appear more than once and so should depend irrationally on the radial integrals, only two of the three ^2D terms do so. The formulæ satisfactorily represent the d^5 terms of Cr II. N. M. B.

Degeneracies among terms of a configuration of equivalent electrons. O. Laporte and J. R. Platt (*Physical Rev.*, 1942, [ii], **61**, 305—308; cf. preceding abstract).—Mathematical. If the radial integrals occurring in the term formulæ for a configuration l^s assume certain integer ratios all elements of the energy matrix become low multiples of a common val.; hence high degeneracies occur. This is due to the existence of an identity concerning sums of products of three integrals of spherical harmonics. The regularity serves in the approx. allocation of energy levels or as a check for exact energy formulæ. Ostrofsky's formulæ for d^4 (cf. A., 1934, 1285) are corr. N. M. B.

Relative *f*-values for lines of Ti II. R. B. King (*Astrophys. J.*, 1941, **94**, 27—29).—Relative *f*-vals. for 63 lines in 17 multiplets of Ti II in the range 3143—3761 A. are obtained from measurements of the total absorptions of lines of Ti in the electric furnace at temp. up to 3000°. E. R. R.

Solar corona. M. N. Saha (*Nature*, 1942, **149**, 524—525).—It is suggested that the highly stripped atoms of Fe and Ni which give rise to corona lines are produced in a nuclear reaction, analogous to U fission, occurring in the reversing layer. A. A. E.

Dynamics of the interstellar medium. I. Local equilibrium. L. Spitzer, jun. (*Astrophys. J.*, 1941, **93**, 369—379). E. R. R.

Spectrum of the shell of Pleione. O. Struve and P. Swings (*Astrophys. J.*, 1941, **93**, 446—452). E. R. R.

Visual spectrum of Pleione. J. L. Greenstein (*Astrophys. J.*, 1941, **93**, 453—454). E. R. R.

Emission lines in spectra of B1985 and WY Geminorum. P. Swings and O. Struve (*Astrophys J.*, 1941, **93**, 455—460; cf. A., 1941, I, 310). E. R. R.

Radiation pressure in the convective stellar model. L. R. Henrich (*Astrophys. J.*, 1941, **93**, 483—501). E. R. R.

Mean absolute magnitudes of stars of spectral types O5—B5. R. E. Wilson (*Astrophys. J.*, 1941, **94**, 12—20). E. R. R.

Physical processes in gaseous nebulæ. XVI. Abundance of O III. XVII. Fluorescence in high-excitation planetaries. D. H. Menzel and L. H. Aller (*Astrophys. J.*, 1941, **94**, 30—36, 436—448).—XVI. The density of O III ions, as determined from the abs. intensities of the green nebular lines of O III 5007, 4959, and 4363 A., is ~1 per c.c. This abundance, though only ~0·0001 of that of H ions, is sufficient to produce marked depression of temp. through collisional excitation. Observed electron temp. are consistent with earlier theory.

XVII. Bowen's explanation of the appearance of "fractional multiplets" of O III in the spectra of high-excitation planetaries is tested quantitatively by predicting relative intensities of the ultra-violet lines from suitable equations of statistical equilibrium for the excited levels. Consistent agreement with the observed vals. is found. The non-appearance of permitted O III lines and the magnitude of the He II lines are explained. Relevant vals. for *f* and *A*, computed from approx. (Slater) wave-functions, are tabulated. E. R. R.

Spectrophotometry of 67 bright stars with a photo-electric cell. J. S. Hall (*Astrophys. J.*, 1941, **94**, 71—93). E. R. R.

β-Canis Majoris. O. Struve and P. Swings (*Astrophys. J.*, 1941, **94**, 99—108). E. R. R.

Spectrum of HK Scorpii. C. T. Elvey (*Astrophys. J.*, 1941, **94**, 140). E. R. R.

Variations of CL and HK Scorpii. (Miss) H. H. Swope (*Astrophys. J.*, 1941, **94**, 141—142). E. R. R.

Spectrographic study of the eclipsing variable WW Draconis. A. H. Joy (*Astrophys. J.*, 1941, **94**, 407—411). E. R. R.

The grating infra-red solar spectrum. V. Atomic lines in the far infra-red. VI. Map from 14 μ. to 7 μ. A. Adel (*Astrophys. J.*, 1941, **94**, 449—450, 451—467).—V. Six intense lines are tentatively correlated with the transitions $3D$–$3P$ for Na I and $6P$–$5D$ for K I.

VI. A map of the infra-red spectrum, showing actual resolving power of 1 cm.$^{-1}$ throughout, with tables of $\lambda\lambda$ and $\nu\nu$, is given. E. R. R.

Classification of red carbon stars. P. C. Keenan and W. W. Morgan (*Astrophys. J.*, 1941, **94**, 501—510). E. R. R.

Hydrogen emission in 25 Cygni. W. A. Hiltner (*Astrophys. J.*, 1941, **94**, 548). E. R. R.

Inverse Stark effect and electrical double refraction. F. Gabler (*Physikal. Z.*, 1941, **42**, 67—72).—The inverse Stark effect, and the transverse electrical double refraction in the neighbourhood of certain absorption lines which accompanies it, have been investigated for Na and K. An at. beam was used as an absorbing layer. Double refraction was observed with the Na D_2 line but not with the D_1 line. The latter suffers displacement only in an electric field. The corresponding K line (7645 A.) also shows no electrical double refraction. A. J. M.

***X*-Ray absorption structure as a tool in physics and chemistry.** S. T. Stephenson (*J. Appl. Physics*, 1942, **13**, 142—146). A. J. E. W.

***X*-Ray *L*-series satellite lines.** L. Pincherle (*Physical Rev.*, 1942, [ii], **61**, 225—233; cf. Randall, A., 1940, I, 276).—The $L\alpha$ and $L\beta$ satellites are ascribed to doubly ionised atoms, and $\lambda\lambda$ and relative intensities are calc. by the self-consistent field method. Computed and observed satellite profile structures are compared. Full data and separations are tabulated, and a proposed classification of experimental component lines in terms of theoretical transitions is given. N. M. B.

Auger effect in relative intensities and widths of *X*-ray lines. J. N. Cooper (*Physical Rev.*, 1942, [ii], **61**, 234—242).—A two-crystal spectrometer study of certain *L* lines in the range $Z = 70$—81 shows that for ^{73}Ta—^{81}Tl the widths of lines from L_I initial states increase in energy by ~6 e.v., and the widths of lines from L_{II} and L_{III} initial states increase by ~1 e.v.; intensities of L_I lines relative to intensities of L_{II} and L_{III} lines show a marked decrease with *Z*. Both variations can be attributed to the rapid increase with *Z* of the probabilities of the Auger transitions $L_I \rightarrow L_{III}M_{IV}$ and $L_I \rightarrow L_{III}M_V$. Results on line widths accord with the Weisskopf–Wigner theory. Data indicate that Auger transitions are of prime importance in determining the relative intensities and widths of certain *X*-ray lines. N. M. B.

Retardation of electrons at *X*-ray levels. G. Ruthemann (*Naturwiss.*, 1942, **30**, 145).—The velocity spectrum of 7·5-ke.v. electrons after passing through very thin films of collodion shows irregularities at the *K*-ionisation levels of O, N, and C. A. J. M.

Multiple scattering of fast electrons. L. A. Kulchitsky and G. D. Latyshev (*Physical Rev.*, 1942, [ii], **61**, 254—265).—With a special apparatus and Geiger–Müller counters, the scattering of 2·25-Me.v. electrons is studied in foils of Al, Cu, Fe, Mo, Ag, Sn, Ta, Au, and Pb. Results are plotted and compared with Williams' multiple scattering

theory (cf. A., 1940, I, 399). For ^{13}Al—^{50}Zn results coincide with theory; for heavy elements ^{73}Ta, ^{79}Au, and ^{82}Pb, the experimental vals. are 10—13% < calc. N. M. B.

Electron emission of metals in electric fields. III. Transition from thermionic to cold emission. E. Guth and C. J. Mullin (*Physical Rev.*, 1942, [ii], **61**, 339—348; cf. A., 1941, I, 312).—The theory of Schottky emission is extended to include in the current those electrons which tunnel through the top of the potential barrier at the metal surface when fairly strong electric fields are used. These electrons contribute to the periodic deviations from the Schottky line, increasing the amplitude of the deviations in accordance with experiment. This necessitates a very small Nottingham reflexion coeff. for fields $>10^4$ v. per cm. Expressions are developed for the electron current emitted by a metal for field intensities in the thermionic work—cold emission range. Results are obtained for the temp.- and field-dependence of the electron current for relevant ranges including the "transition region." N. M. B.

Angular distribution of positron annihilation radiation. R. Beringer and C. G. Montgomery (*Physical Rev.*, 1942, [ii], **61**, 222—224).—High-resolution counter observations of the angular distribution of the two quanta emitted in the annihilation of a positron and an electron are consistent with the view that the two quanta are emitted in exactly opposite directions to within 1°. The angular half-width of a possible distribution of deviations from strict collinearity is <15′. It is concluded that the momentum balance is accurately maintained by the quanta alone, and that, in general, a positron stops before annihilation in accord with theory. N. M. B.

Distribution in angle of protons from the D–D reaction. H. P. Manning, R. D. Huntoon, F. E. Myers, and V. J. Young (*Physical Rev.*, 1942, [ii], **61**, 371—374).—Angular distribution of the disintegration protons from the D–D reaction, investigated as a function of energy for 60—390 ke.v., is represented by $I(\theta) = 1 + A\cos^2\theta$ at any one energy. The val. of A increases smoothly with bombarding energy over the range. N. M. B.

Chemical elements and naturally occurring atoms from the viewpoint of isotope and nucleus investigation. O. Hahn, S. Flügge, and J. Mattauch (*Ber.*, 1942, **75**, [*A*], 14—16).—An addendum to the report of January, 1940 (cf. A., 1940, I, 185), deals with C, O, Co, Ni, Fe, Yb, and Pb. H. W.

Vapour density method for determination of at. wt. T. Batuecas (*Z. anorg. Chem.*, 1941, **246**, 158—168).—Magnus and Schmid's data (A., 1922, ii, 260) on v.d. of C_6H_6 and $CHCl_3$ have been re-evaluated using a different system of calculation. This leads to 12·0045±0·0008 and 35·460±0·011 as at. wts. of C and Cl, respectively, and confirms that their method is applicable to exact determination of at. wts. J. W. S.

At. wt. of zinc. O. Hönigschmid and M. von Mack (*Z. anorg. Chem.*, 1941, **246**, 363—369).—Pure $ZnCl_2$ was prepared from gaseous HCl and vac.-distilled Zn at 700° and was twice distilled in a current of HCl. The at. wt. of Zn is determined from measurement of the ratio $ZnCl_2 : 2Ag : 2AgCl$. The mean val., 65·377±0·001, confirms the accepted chemical val. and is > the mass-spectrographic val. O. D. S.

Radioactivity and the completion of the periodic system. F. A. Paneth (*Nature*, 1942, **149**, 565—568).—A lecture. A. A. E.

Absorption of the primary β-radiation from radium in lead and platinum and specific γ-ray dose rate at filtration of 0·5 mm. of platinum. G. J. Neary (*Brit. J. Radiol.*, 1942, **15**, 104—109).—The range of β-radiation from Ra in Pt, estimated from measurements on Pb, is 0·53 mm. The β–γ ionisation ratio after 0·50 mm. Pt is ~1%. The mass absorption coeff. of Pt for the hard β component is 7·7 cm.^{2} per g. 1 mg. of Ra filtered by 0·5 mm. Pt gives γ-ray dose rate 8·47 e.s.u. per c.c. per hr. in air. L. J. J.

Activation of lanthanum with neutrons. H. Götte (*Naturwiss.*, 1942, **30**, 108).—Bombardment of La with 15·2-me.v. neutrons gives a product of half-life 44 hr., identical with that obtained by the use of slow neutrons. Experiments on absorption in Al with the ^{140}La (44 hr.) obtained by the use of rapid and slow neutrons, and by fission of U, indicate that all three are identical. A. J. M.

Nuclear levels of ^{5}Li. G. Beck and S. T. Tsien (*Physical Rev.*, 1942, [ii], **61**, 379).—Experimental analysis of the angular and velocity distribution of protons projected by incident α-particles indicates that ^{5}Li has levels with energies 0·56, 0·64, 0·74, 0·83, 0·91, and 1·00 Me.v., with spacing and breadth ~0·1 Me.v. An analysis of these results by Wentzel's criteria is discussed. Agreement with theory is satisfactory. N. M. B.

Nuclear spin and magnetic moment of ^{40}K. J. R. Zacharias (*Physical Rev.*, 1942, [ii], **61**, 270—276).—Because of the small abundance of ^{40}K, a modified apparatus and form of the mol. beam magnetic resonance method are used to observe the nuclear spin and hyperfine structure $\Delta\nu$. The vals. found are spin 4 and $\Delta\nu$ 1285·70±0·1 Mc. The doublet is inverted. By comparison with the known nuclear moment of ^{39}K, that of ^{40}K is −1·290 nuclear magnetons. N. M. B.

γ-Ray transition of the isotope of bromine (^{80}Br) 4·5 hours. A. Krebs (*Naturwiss.*, 1942, **30**, 121).—In the chemical separation of ^{80}Br (18 min.) and ^{80}Br (4·5 hr.), 85% of the unconverted nuclei are found in the ppt. It is concluded that in the case of 85% of the disintegrating nuclei, the γ-quantum suffers an internal transformation. This does not agree with the work of Siday (A., 1941, I, 394). A. J. M.

Radiations from radioactive gold, tungsten, and dysprosium. A. F. Clark (*Physical Rev.*, 1942, [ii], **61**, 242—248; cf. Mitchell, A., 1940, I, 338).—From measurements of β–γ and γ–γ coincidences and known energies of the emitted radiations, level schemes are deduced for Au and W. The β-ray spectrum of ^{198}Au is simple, with an end-point of 0·78 Me.v.; the residual nucleus emits two γ-rays in cascade. ^{197}W has a complex spectrum; the high-energy group max. is 1·4, and the lower-energy group has an end point at 0·5 and is followed by a 0·9-Me.v. γ-ray and other γ-rays which give γ–γ coincidences. The Dy β-ray end-point is 1·2 and the max.-energy γ-ray is 1·1 Me.v. N. M. B.

Theoretical half-lives of β-activities. C. L. Critchfield (*Physical Rev.*, 1942, [ii], **61**, 249—254; cf. A., 1941, I, 439).—Vals. are calc., as a function of the max. energy and the nuclear charge, for forbidden β-transitions in the usual five types of interaction of Fermi's theory of β-decay. The half-lives in most first forbidden and some second forbidden transitions vary approx. as w^{-5} (w = max. energy) as for allowed transitions, but, in general, may be $\propto w^{-7}$ and $w^{-7\text{ or }-9}$, respectively. N. M. B.

Separation of element 93. K. Starke (*Naturwiss.*, 1942, **30**, 107—108).—Preps. have been made by the method of Szilard *et al.* (A., 1934, 1152) in which $^{239}_{92}$U has been enriched 10^5-fold. After the decay of the 23-min. nucleus $^{239}_{92}$U, a further decay of 2·4 days half-life period was found which may be due to a nucleus $^{239}_{93}$El (cf. Macmillan *et al.*, A., 1940, I, 340). A. J. M.

Production of divergent penetrating secondary corpuscles by cosmic rays. P. Auger and J. Daudin (*Compt. rend.*, 1941, **213**, 24—26). A. J. M.

Production and absorption of mesotrons. G. Wataghin (*An. Acad. Brasil. Cienc.*, 1942, **14**, 79—81).

Mesotron component of cosmic rays. H. D. Rathgeber (*Physical Rev.*, 1942, [ii], **61**, 207—211). N. M. B.

Intensities of the hard and soft components of cosmic rays as functions of altitude and zenith angle. K. Greisen (*Physical Rev.*, 1942, [ii], **61**, 212—221). N. M. B.

Mesotron studies with dual telescope. F. A. Benedetto, G. O. Altmann, and V. F. Hess (*Physical Rev.*, 1942, [ii], **61**, 266—269).—The cosmic-ray telescope previously used is described (cf. A., 1942, I, 37), and a more detailed analysis of results is given. N. M. B.

Cloud-chamber track of a mesotron stopped by gas. T. H. Johnson and R. P. Shutt (*Physical Rev.*, 1942, [ii], **61**, 380—381; cf. A., 1942, I, 162). N. M. B.

Internal temperature-density distribution of the sun. G. Blanch, A. N. Lowan, R. E. Marshak, and H. E. Bethe (*Astrophys. J.*, 1941, **94**, 37—45). E. R. R.

Quantum numbers and the periodic table. T. H. Hazlehurst (*J. Chem. Educ.*, 1941, **18**, 580—581). L. S. T.

New key in the interpretation of physics. S. Autúnez de Mayolo (*Bol. Soc. Quim. Peru*, 1942, **8**, 5—28).—An electromagnetic theory based on a helicoidal motion of photons. F. R. G.

Physical interpretation of quantum mechanics. P. A. M. Dirac (*Proc. Roy. Soc.*, 1942, **A, 180**, 1–40).—Bakerian lecture. G. D. P.

Approximate solution of Schrödinger equations by a least-squares method. A. A. Frost (*J. Chem. Physics*, 1942, **10**, 240—245).—Mathematical. W. R. A.

Statistical forces. L. Goldstein (*J. Chem. Physics*, 1942, **10**, 295—297).—A two-particle force in co-ordinate space represents the apparent coupling between two spinless atoms in Bose–Einstein and Fermi–Dirac assemblies at all temp. ≫ their transition temp. L. J. J.

Compressibility and electron volume. H. Koppe (*Z. anorg. Chem.*, 1941, **246**, 131—137).—Biltz and Klemm's relation between the compressibility and electron vol. of metals is derived theoretically from simple assumptions regarding kinetic and exchange energies of electron gas. J. W. S.

II.—MOLECULAR STRUCTURE.

Curve shape index for identification by means of spectrophotometric curves. W. A. Shurcliff (*J. Opt. Soc. Amer.*, 1942, **32**, 160—163).—A method of indexing the absorption curves of dyes is described which enables rapid identification of unknown materials. O. D. S.

Measurements of ultra-violet solar- and sky-radiation intensities in high latitudes. W. W. Coblentz, F. R. Gracely, and R. Stair (*J. Res. Nat. Bur. Stand.*, 1942, **28**, 581—591). A. R. P.

High rotational levels and partition function for hydrogen. H. W. Woolley (*J. Chem. Physics*, 1941, **9**, 470—472).—Inversion of the ordinary rotating-vibrator formula gives improved convergence in the series used for calculating energy of high rotational levels in a diat. mol. L. J. J.

Absorption spectrum of chlorine fluoride. A. L. Wahrhaftig (*J. Chem. Physics*, 1942, **10**, 248).—ClF exhibits a band system at 4800 A. similar to the $^3\Pi_0^+ \rightarrow {}^1\Sigma^+$ system of ICl. Vibrational and rotational analyses are made, and mol. consts. are given. Vals. of the dissociation energy of F_2 and the heat of formation of ClF are deduced. W. R. A.

Nature of electronic levels in ultra-violet spectra of hydrogen and alkyl halides. R. S. Mulliken (*Physical Rev.*, 1942, [ii], **61**, 277—283; cf. A., 1940, I, 285).—The discussions include ICl, IBr, and BrCl. It is concluded that the excited orbital of the H halides is of σ type in the *B,C* bands, but of $p\pi$ type in the *D,E* bands. For the upper level of the *B* and *C* bands the coupling changes from nearly *J,j*-like in the iodides to predominantly *L,S*-like in the chlorides. The tendency towards *L,S*-like coupling is greater in the H than in the alkyl halides. For the *B,C* "satellites" in HCl, a $4p\sigma$ excited orbital is indicated. The *D,E* bands show nearly *J,j*-like coupling for all halides. The natures of the excited orbitals in observed Rydberg series are discussed. Two of the most prominent series start with the *A* continuum and with the *D,E* bands, and so should have σ and $p\pi$ excited orbitals, respectively. The $np\pi$ "non-bonding" orbital in the normal states of the H halides and other diat. hydrides is probably slightly bonding. N. M. B.

Methyl iodide absorption bands near λ 2000. R. S. Mulliken and E. Teller (*Physical Rev.*, 1942, [ii], **61**, 283—296).—The theory of the types and structures of bands in an electronic transition in an axially symmetrical mol. of symmetry C_{3v} is discussed. This is applied to the MeI *B* band system near λ 2000 and the two observed types of bands are explained. The pseudo-parallel bands are electronic-allowed perpendicular bands, their narrowness of structure resulting from an electronic angular momentum of 1 in the upper state. The weak widely-spaced bands are another type of perpendicular bands allowed by an interaction of the degenerate electronic state with a degenerate (*e*-type) vibration; they are $1 \leftarrow 0$ and $0 \leftarrow 1$ bands of such a vibration and of a second similar vibration. Their spacing is explained. Mol. consts. for the ground and excited electronic states are tabulated. The theory of the coupling of spin, orbital and angular momentum, and mol. vibration for various strengths of spin–orbit coupling is discussed. N. M. B.

Infra-red bands of hydrogen peroxide at λ 9720 and structure and torsional oscillation of hydrogen peroxide. L. R. Zumwalt and P. A. Giguère (*J. Chem. Physics*, 1941, **9**, 458—462).—Data are recorded for the fine structure of the OH bands of H_2O_2 at 9720 A. Rotational analysis of the hybrid bands 10283·68 cm.$^{-1}$ and 10291·08 cm.$^{-1}$ gives vals. $2{\cdot}78_6 \times 10^{-40}$ g. cm.^{2} for the smallest, and $33{\cdot}9 \times 10^{-40}$ g. cm.^{2} for the harmonic mean of the two largest, of the mol. moments of inertia. A non-planar configuration is indicated. L. J. J.

Infra-red absorption of silver cyanide. W. D. Stallcup and D. Williams (*J. Chem. Physics*, 1942, **10**, 199—200).—Powdered AgCN absorbs intensely at 2178 cm.$^{-1}$ (CN group), ~100 cm.$^{-1}$ > CN νν of of NaCN and KCN. W. R. A.

Spectra of chilled hydrocarbon flames. A. G. Gaydon (*Proc. Roy. Soc.*, 1942, **A**, **179**, 439—450).—The spectrum of the outer cone of hydrocarbon flames struck back in a water-cooled steel burner shows the ultra-violet bands usually known as the C_2H_4-flame bands. Under suitable conditions the bands are very strong. Chemical tests show that their occurrence is closely associated with the formation of a peroxide, probably an alkyl peroxide. The bands are not necessarily associated with the presence of aldehydes in the interconal gases. Various catalysts have little effect on the spectrum. The observations indicate the radical HCO as the emitter of the bands and a mechanism for its formation is suggested. G. D. P.

Heat of sublimation of carbon. G. Herzberg (*J. Chem. Physics*, 1942, **10**, 306—307).—Polemical against Kynch and Penney (A., 1942, I, 134). L. J. J.

Absorption spectra and constitution of acid anthraquinone dyes.—See A., 1942, II, 229.

Absorption of unsymmetrical cyanines. Resonance as a basis for a classification of dyes.—See A., 1942, II, 238.

Quenching and depolarisation of resonance radiation by collisions with molecules of a foreign gas. S. Mrozowski (*Physical Rev.*, 1942, [ii], **61**, 379—380).—A discussion of the results of Ellett *et al.* (cf. A., 1941, I, 398) and Olsen (cf. A., 1942, I, 126) with reference to Mitchell (cf. A., 1934, 936). N. M. B.

Fluorescence of phosphors in the rare gases. G. R. Fonda and H. Huthsteiner (*J. Opt. Soc. Amer.*, 1942, **32**, 156—160).—The excitation of fluorescence in a no. of phosphors in discharges through Ne, He, A, and Kr has been investigated. The behaviour of individual phosphors under these conditions is not correlated with their behaviour with other exciting λλ. Ca tungstate and Zn silicate phosphors are the most efficient in the rare-gas discharge. For Zn silicate the efficiency is increased by the removal of the free SiO_2 usually present, and, assuming that resonance radiation is the source of excitation, it is deduced that the quantum efficiency of fluorescence is ~1. The variation in intensity of fluorescence with the gas pressure is investigated. O. D. S.

Intramolecular energy transfer. Fluorescence of complexes of europium. S. I. Weissman (*J. Chem. Physics*, 1942, **10**, 214—217).—In certain org. derivatives of Eu the characteristic line fluorescence of Eu^{III} is excited by irradiation with light absorbed only by the org. part of the compound. The nature of the compound, temp., and solvent cause great variations in the efficiency of excitation; approx. unit efficiency is obtained with solutions of a covalent compound at liquid-air temp. The decay time of fluorescence is independent of quenching which prevents excitation of the $Eu^{...}$ ion. There appears to be a steady gradation of efficiency of transfer from covalent to ionic compounds. W. R. A.

Polarisation of luminescence in crystals. B. V. Thosar (*J. Chem. Physics*, 1942, **10**, 246—247).—Using the technique of the polarisation of Raman lines, the state of polarisation of the sharp red luminescence doublet of ruby at 6936 A. and of three anti-Stokes bands of the doublet is investigated by measuring the ratio the intensities of luminescence parallel and perpendicular to *OZ*. The results are explained on a general interpretation of crystal luminescence which is being developed. W. R. A.

Quantitative Raman spectrum analysis.—See A., 1942, I, 247.

Raman line of cyanide ion. G. Glockler and H. T. Baker (*J. Chem. Physics*, 1942, **10**, 305—306).—Of the two lines 838 and 2080 cm.$^{-1}$ ascribed to CN^-, only the latter is genuine, with frequency 2086·7±2·7 cm.$^{-1}$ The former is due to CNO^-. The force const. of CN^- is 1·65 megadynes per cm. L. J. J.

Raman spectra of monoalkylbenzenes and monoalkyl*cyclo*hexanes. J. Goubeau and E. Köhler (*Ber.*, 1942, **75**, [*B*], 65—72).—The lines 621, 1002, 1029, 1155, and 1604 cm.$^{-1}$ remain unchanged from PhMe to $C_{16}H_{32}Ph$ with a mean deviation of ±1 cm.$^{-1}$; the lines 1202, 1581, and 3057 cm.$^{-1}$ behave similarly but with somewhat greater deviation. These oscillations are therefore not influenced by the length of the side-chain. ω_4, however, depends markedly thereon although the influence does not extend beyond the third C. Changes in the lowest frequencies, γ, ω_{10}, and ω_1, are less obvious. As the length of the side-chain increases, the frequencies of the unbranched aliphatic chain become obvious. This increase is most marked with 1300 cm.$^{-1}$ and it may possibly be used to measure the length of the chain. The lines 444, 780, 842, 1032, 1079, 1161, 1261, 1347, and 1366 cm.$^{-1}$ appear in the spectra of all monoalkyl*cyclo*hexanes; there does not appear to be a frequency dependent on the length of the side-chain. H. W.

Photovoltaic effect. E. Adler (*J. Chem. Physics*, 1941, **9**, 486).—A reply to Cassel (A., 1941, I, 234). L. J. J.

Magnitude of solvent effect in dipole moment measurements. V. Solvent-effect constant and moments of alkyl iodides. A. Audsley and F. R. Goss (*J.C.S.*, 1942, 358—366).—Polarisation consts. of of 18 alkyl iodides, including higher members, in CCl_4 have been determined; results agree with the solvent effect equation (A., 1938, I, 136). The dipole moments are calc. from the coeffs. in this equation by the intercept ratio (A., 1941, I, 354, 358) and the additive nature of the at. polarisation (A., 1942, I, 91). The primary series exhibits an alternation of moments, even members having higher, and odd ones lower, moments. The moments and solvent effect consts. of *sec.* and *tert.* iodides also fall into regular series, the decrement in each case being 0·01 D. The solvent effect const. is defined, and its connexion with mol. structure is discussed; the Debye theory can be adapted to the liquid state even if the mols. are far from spherical. The equation and const. link the Lorenz field with the more correct Onsager field. Alkyl chains in the liquid phase appear to be curled; in the vapour state they are free to rotate. A. J. M.

Heavy water. P. W. Selwood (*J. Chem. Educ.*, 1941, **18**, 515—520).—A review. L. S. T.

Strength of carbon–hydrogen and carbon–carbon bonds. D. P. Stevenson (*J. Chem. Physics*, 1942, **10**, 291—294).—The bond strengths Me–H, Et–H, Me–Me, and Et–Et are calc. from (unpublished) electron impact crit. potential data as 101, 96, 82·6, and 77·6 kg.-cal. per mol. L. J. J.

Carbon–hydrogen bond strengths in methane and ethane. H. G. Andersen, G. B. Kistiakowsky, and E. R. van Artsdalen (*J. Chem. Physics*, 1942, **10**, 305).—The temp.-dependence of the rate of photochemical bromination of CH_4 gives 17·8 kg.-cal. for the activation energy of $Br + CH_4 = CH_3 + HBr$, leading to 102±1 kg.-cal. for the C–H bond strength. The corresponding activation energy and bond strength in C_2H_6 are 13·8 and 98±2 kg.-cal. L. J. J.

Calculation of steric hindrance. A. G. Evans and M. Polanyi (*Nature*, 1942, **149**, 608).—The steric effect of non-reacting groups on substitution rates is discussed with reference to the symmetrical substitution of $Bu^{\gamma}Cl$ by Cl ions. The distance between the centres of the obstructing H atoms and the centre of the Cl particle is calc. as 2·43 A., *i.e.*, 0·57 A. < the sum of the van der Waals radii of H and Cl. The corresponding energy of the compression involved in the reaction has been calc. and a model representing the transition state is described. A. A. E.

Diamagnetic anisotropy and the method of molecular orbitals. H. Brooks (*J. Chem. Physics*, 1941, **9**, 463—465).—Modification of the simple London theory for a non-orthogonality of 25% between wave-functions of adjacent atoms in org. mols. has little effect on calc. diamagnetic anisotropy, except for Ph_2. L. J. J.

Thermodynamic functions of paramagnetic substances and harmonic operators. J. R. Hull and R. A. Hull (*J. Chem. Physics*, 1941, **9**, 465—469).—Vals. are tabulated for partition function, magnetic moment, S/R, and $T(\partial S/\partial T)_H$ for free paramagnetic ions with j ½, ⅔, and ⅝, in magnetic field H. Vals. for an Einstein oscillator are also calc. L. J. J.

Thermodynamic functions for molecules with internal rotation. K. S. Pitzer and W. D. Gwinn (*J. Chem. Physics*, 1941, **9**, 485—486).—Pitzer's formulæ and tables (A., 1937, I, 398) are accurate for all mols. having moments of inertia independent of the angle of internal rotation. An alternative derivation based on Crawford's analysis (A., 1940, I, 198) is outlined. L. J. J.

***X*-Ray study of liquid benzene, *cyclo*hexane, and their mixtures.** P. H. Bell and W. P. Davey (*J. Chem. Physics*, 1941, **9**, 441—450).—A Geiger–Müller counter was used with monochromatic Mo $K\alpha$ radiation. Pure C_6H_6 and *cyclo*hexane at 25° show new peaks at 4° 20′ and 4° 0′, broader and flatter than the sharp peaks at twice these angles. In mixtures the main peak has three sharp summits. The results are consistent with the cybotactic structure described. L. J. J.

Atomic distributions in liquid elements. C. Gamertsfelder (*J. Chem. Physics*, 1941, **9**, 450—457).—Mo $K\alpha$ patterns and Fourier analyses thereof are given for liquid Cl_2, Sn, In, Zn, Cd, Al, and Li. The at. distributions found are consistent with diat. Cl_2 in the liquid, and in good agreement with cryst. spacings for liquid Sn, Zn, and Al. L. J. J.

Interference at axially oriented polyatomic gas molecules. O. Steiner (*Naturwiss.*, 1942, **30**, 121—122).—The mathematical function governing the interference of *X*-rays or electrons at axially oriented polyat. gas mols. is given. Interference should occur at greater scattering angles than for non-oriented mols. A. J. M.

III.—CRYSTAL STRUCTURE.

Diffuse reflexion of *X*-rays by anisotropic and isotropic solids. H. A. Jahn and (Mrs.) K. Lonsdale (*Physical Rev.*, 1942, [ii], **61**, 375—376).—Experimental data for single crystals of Na, Li, Pb, KCl, and NaCl agree well with a formula previously found (cf. A., 1941, I, 195) for cubic lattices. A simplification of the formula for the case of isotropic solids is examined. N. M. B.

Temperature-diffuse scattering. M. Born (*Physical Rev.*, 1942, [ii], **61**, 377—378).—A discussion of Zachariasen (cf. A., 1942, I, 135), and a correction of his method of deriving the general intensity formula (cf. A., 1940, I, 285). N. M. B.

***X*-Ray microscope.**—See A., 1942, I, 249.

Indexing powder diffraction patterns of isomorphous substances. L. K. Frevel (*J. Appl. Physics*, 1942, **13**, 109—112). O. D. S.

Crystallographic structure of alkaline-earth oxide mixtures. Study of oxide cathodes by *X*-rays and electrons. H. Huber and S. Wagener (*Z. tech. Physik*, 1942, **23**, 1—12).—BaO–CaO, BaO–SrO, and SrO–CaO cathodes have been studied by the Debye–Scherrer method; the variation of the lattice consts. with mixture composition is examined. BaO– and CaO–SrO mixtures form mixed crystals, but BaO and CaO give microcryst. mixtures. The co-pptd. carbonate mixtures from which the cathodes are prepared form mixed crystals throughout. Electron-diffraction experiments by the Seemann method show that each cathode surface is covered with a layer (300—2000 atoms thick) of the less volatile component of the mixture. The results are discussed in relation to the emissive properties of the cathodes. A. J. E. W.

Crystal structure of some strontium–bismuth oxyhalides. ($SrBi_3O_4Cl_3$, $SrBiO_2Br$, $SrBi_2O_3Br_2$, and $SrBi_3O_4Br_3$). L. G. Sillén (*Z. anorg. Chem.*, 1941, **246**, 115—130).—By heating $SrCl_2$ with BiOCl and Bi_2O_3, the *compound* $SrBi_3O_4Cl_3$ has been obtained. When $SrBr_2$ is heated with appropriate mixtures of BiOBr, Bi_2O_3, and SrO the *compounds* $SrBi_3O_4Br_3$, $SrBi_2O_3Br_2$, and $SrBiO_2Br$ are produced. *X*-Ray investigations show that these comprise metal and O atoms in planes alternating with the planes containing halogen atoms. All are tetragonal with $a \sim 3{\cdot}9$ A. The charge distribution is discussed in relation to Pauling's rule (A., 1929, 748). J. W. S.

Crystal structure of some cadmium–bismuth oxychlorides and oxybromides. L. G. Sillén (*Z. anorg. Chem.*, 1941, **246**, 331—346).—Cryst. phases of analogous structure to those described earlier for a no. of oxyhalides (cf. A., 1939, I, 457) are isolated from the system BiOCl, Bi_2O_3, CdO, excess $CdCl_2$, and the corresponding oxybromide system. The structure of these phases, determined by *X*-ray methods, is found to be of three types: X_3, with triple halogen layers between the metal–oxygen layer, X_2X_3 with alternating double and triple halogen layers, and $X_2X_2X_3$ in which two double layers are followed by a triple layer. The formulæ of the phases of these types are respectively X_3, $Cd_{2-3x}Bi_{1+2x}O_2Hal_3$ ($x = 0{\cdot}2$—$0{\cdot}3$); X_2X_3, $Cd_{2-3x}Bi_{3+2x}O_4Hal_5$; and $X_2X_2X_3$ $Cd_{2-3x}Bi_{5+2x}O_6Hal_7$. The compound $CdBiO_2Br$ exists in two cryst. forms with differing cell dimensions. O. D. S.

Structure and thermal properties associated with some hydrogen bonds in crystals. IV. Isotope effects in some acid phosphates. A. R. Ubbelohde and I. Woodward (*Proc. Roy. Soc.*, 1942, **A**, **179**, 399—407; cf. A., 1940, I, 151).—The expansion of the lattice of $NH_4H_2PO_4$ due to the substitution of D for H is measured. It takes place in the direction of the H bonds and is of the same magnitude as in the isomorphous KH_2PO_4. A contraction in the plane at right angles to the H bonds is considerably larger in the NH_4 salt. Attention is called to the presence of diffuse reflexions in photographs of the monoclinic form of KD_2PO_4. Attempts to obtain $NH_4D_2PO_4$ and KH_2PO_4 in the monoclinic form were not successful. G. D. P.

Structure of polychloroprene. C. J. B. Clews (*Proc. Roy. Soc.*, 1942, **A**, **180**, 100—107)—Polychloroprene, examined by *X*-rays before and after light-treatment, shows no change of crystal. The unit cell is possibly orthorhombic with a 8·90, b 4·70, c 12·21 A., containing four C_4H_5Cl units. G. D. P.

Molecular structure and rubber-like elasticity. I. Crystal structure of β gutta-percha, rubber, and polychloroprene. II. Stereochemistry of chain polymers. III. Molecular movements in rubber-like polymers. C. W. Bunn (*Proc. Roy. Soc.*, 1942, **A**, **180**, 40—66, 67—81, 82—99).—I. The structures are as follows: β-gutta-percha (**I**), orthorhombic, a 7·78, b 11·78, c 4·72 A.; rubber (**II**), monoclinic, a 12·46, b 8·89, c 8·10 A., β 92°; polychloroprene (**III**), orthorhombic, a 8·84, b 10·24, c 4·79 A. In all cases four long-chain mols. pass through the unit cell parallel to the c axis. The co-ordinates of the C atoms are given; there is a close analogy between the structures of (**I**) and (**III**). In all three cases the mols. are asymmetric and have non-planar zigzag chain forms.

II. A survey of the structure of mols. containing two or more singly linked C atoms favours the "staggered bond" configuration, in which the bonds issuing from a pair of neighbouring C atoms do not fall over one another in plan but form a six-rayed star, the bonds *abc* belonging to one C atom, *a′b′c′* to the other. If *d* denotes the bond between the two C atoms, sequences *a′da*, *a′db*, and *a′dc* are possible. Repetition of the first gives a simple zigzag chain of the normal long-chain paraffin type. Repetition of the other two leads to right- and left-handed spirals of C atoms. Mols. with N, O, and S atoms seem to conform to the "staggered-bond" principle. The non-planar chain forms of (**I**), (**II**), and (**III**) are attributed to the co-operation of the principle of staggered bonds and the repulsion between Me or Cl side substituents and particular CH_2 groups in the chains.

III. In (**I**) and (**III**) changes in mol. configuration due to rotation around the single bonds occur at the "m.p." The relatively low "m.p." compared with polyethylene is ascribed to greater freedom of this rotation. The differences between the mechanical properties and "m.p." of (**I**) and those of (**II**) receive a qual. explanation. G. D. P.

Electron diffraction studies on thin films. III. Powder patterns containing anomalies produced by secondary scattering. L. H. Germer (*Physical Rev.*, 1942, [ii], **61**, 309—312; cf. A., 1942, I, 47).—Owing to tolerance in glancing angle in the production of diffracted electron beams, each first-order beam can again be diffracted by the same set of planes to give an apparent second-order beam. In patterns from polycryst. substances this results in strengthening of all second-order diffraction rings. The effect is appreciable only with large individual crystals, and can be observed only when a true second-order ring is very weak. The effect is observed in patterns from CuCl, CuBr, and CaF_2. N. M. B.

Magnetisation near boundaries. J. H. Wakelin, jun. (*J. Appl. Physics*, 1942, **13**, 227—235).—Magnetic measurements on rings of Fe–Si, commercially pure Ni, and low-C steel indicate a dependence of magnetic properties on thickness, due to variation of the sp. surface. A. J. M.

Photodichroism of coloured sodium chloride. S. Nikitine (*Compt. rend.*, 1941, **213**, 32—34).—Crystals of NaCl coloured by irradiation with β- and γ-rays from Ra show photodichroism when exposed to the light from a high-pressure Hg lamp. The relative dichroism is not great. An explanation is suggested. A. J. M.

Frequency spectrum of crystalline solids. E. W. Montrole (*J. Chem. Physics*, 1942, **10**, 218—229).—Mathematical. W. R. A.

Validity of the Langevin theory of orientation and the possibility of distinguishing between inherent and photo-elastic anisotropy. W. Heller and (Miss) G. Quimfe (*Physical Rev.*, 1942, [ii], **61**, 382).—Proof of the explanation of the linear magneto-optical anisotropy of homogeneous and dispersed systems as a result of orientation of anisotropic elements (mols. or crystals) may be based on the concept that orientation alone should not change the optical properties of the individual elements. This is supported by experiments with a special optical arrangement giving direct vals. of absorption coeffs. parallel and perpendicular to the magnetic field. Results on an Fe oxide sol at fields >10,000 gauss accord closely with Langevin's relation. Hydrodynamical orientation and photo-elasticity or anisotropies not due to orientation alone are discussed. N. M. B.

Elasticity and creep of lead single crystals. I. H. Swift and E. P. T. Tyndall (*Physical Rev.*, 1942, [ii], **61**, 359—364).—The rigidity and Young's moduli of Pb single crystals are measured statically as functions of crystal orientation, and the elastic parameters obtained agree with vals. found dynamically (cf. Goens, A., 1936, 785). The influence of bending-torsion effect on the measurement of rigidity modulus by torsion is studied. The elastic limit for Pb under longitudinal stress occurs when the resolved shear stress on the most favourably placed octahedral plane is $\sim 2 \times 10^6$ dynes per sq. cm. Observations of transient creep under longitudinal stress show that creep strain velocity at any instant is $\propto$ difference between final strain under that load and strain at the instant. N. M. B.

Stress–strain curve for the atomic lattice of mild steel, and the physical significance of the yield point of a metal. S. L. Smith and W. A. Wood (*Proc. Roy. Soc.*, 1942, **A**, **179**, 450—460).—*X*-Ray measurements are made of the lateral contraction which accompanies the extension of a test-piece. Up to the yield point the lattice contraction $\propto$ the applied stress in conformity with Hooke's law; beyond the yield point the spacing undergoes a sudden expansion, which is retained when the load is removed. The permanent expansion imposed on the lattice increases in magnitude up to the ultimate stress, and the intensity of *X*-ray diffraction diminishes by ~50% when yield occurs. G. D. P.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES.

Magnetochemical investigations. XXXVIII. Magnetic behaviour of some compounds of transition elements. H. Bommer (*Z. anorg. Chem.*, 1941, **246**, 275—283).—$Co_2(SO_4)_3,18H_2O$ and $RbCo(SO_4)_2,12H_2O$ are diamagnetic or weakly paramagnetic, and therefore contain penetration complexes (probably $[Co(H_2O)_6]^{\cdots}$). At. linkings probably occur in all Co^{III} compounds, the $Co^{II} \rightarrow Co^{III}$ transition occurring only when the formation of at. linkings liberates energy. $CsMn^{III}(SO_4)_2,12H_2O$ obeys the Curie law accurately (moment 4·91 Bohr magnetons), and thus contains a normal complex. $CsRh(SO_4)_2,12H_2O$ is diamagnetic and contains a penetration complex. A. J. E. W.

Magneto-chemical investigations. XXXIX. Ionic diamagnetism. II. W. Klemm (*Z. anorg. Chem.*, 1941, **246**, 347—362).—The data in the literature for the diamagnetism of ions are critically discussed and correlated. O. D. S.

Anisotropy of ferromagnetic powder particles. E. T. Benedikt (*J. Appl. Physics*, 1942, **13**, 105—109).—The magnetic moments of films of Fe, Fe_2O_3, and Fe_3O_4 deposited by sedimentation in a magnetic field were measured. The particles are anisotropic. O. D. S.

Supersonic dispersion in gases. Vibrational activation of the acetaldehyde molecule. E. A. Alexander and J. D. Lambert (*Proc. Roy. Soc.*, 1942, **A**, **179**, 499—511).—Supersonic dispersion in MeCHO vapour is investigated in piezoelectric, magnetostrictive, and Kundt's-tube interferometers over a wide range of frequency and pressure. A region of multiple dispersion is found implying the activation of intramol. vibrations. G. D. P.

Properties of Bose–Einstein gases. L. Goldstein (*J. Chem. Physics*, 1941, **9**, 472—479).—Relations between Bose–Einstein condensation and heat capacity are discussed. L. J. J.

Statistical thermodynamics of several halomethanes. W. F. Edgell and G. Glockler (*J. Chem. Physics*, 1941, **9**, 484—485).—Vals. of C_p for MeF, MeI, and CH_2Br_2 at 298·1—600° K., calc. to the rigid rotator simple harmonic oscillator approximation, are recorded. L. J. J.

Second virial coefficients and the forces between complex molecules. J. O. Hirschfelder, F. T. McClure, and I. F. Weeks (*J. Chem. Physics*, 1941, **10**, 201—211).—The second virial coeffs. of C_2H_6, C_3H_8, n-C_4H_{10}, n-C_7H_{16}, NH_3, MeCl, some olefines, and the "freons", have been computed from experimental data. At $>T_c$ the second virial agrees with the theorem of corresponding states, but at $<T_c$ dipole mols. have very large virials. Isomeric hydrocarbons give virials which are not sensitive to the shape of the mol. and hence an exact determination of intermol. interaction from the temp. variation of the second virial. Imperfections of a gas arise from the presence of double mols. which exist for the duration of a collision. The equilibrium const. for the formation of double mols. is related to the second virial and its temp. variation gives ΔS and ΔE of their formation, both of which are qualitatively interpretable in terms of intermol. forces. A corresponding-states equation is given for estimating second virials when no experimental data are available. W. R. A.

Thermodynamic properties of air. R. V. Gerhart, F. C. Brunner, H. S. Mickley, B. H. Sage, and W. N. Lacey (*Mech. Eng.*, 1942, **64**, 270—272).—At high pressures air deviates significantly from perfect gas behaviour. Its thermodynamic properties have been computed from available data at pressures up to 3500 lb. per sq. in. for the range 0—288°. R. B. C.

Mechanism for self-diffusion in metallic copper. H. B. Huntington and F. Seitz (*Physical Rev.*, 1942, [ii], **61**, 315—325).—Three mechanisms, direct interchange of atoms, interstitial diffusion, and vacancy diffusion, are discussed on the basis of the modern theory of metals. Results strongly favour the vacancy mechanism and yield a val. of the activation energy for diffusion in fair agreement with observation (cf. following abstract). N. M. B.

Self-consistent treatment of the vacancy mechanism for metallic diffusion. H. B. Huntington (*Physical Rev.*, 1942, [ii], **61**, 325—338; cf. preceding abstract).—A self-consistent solution to the Hartree–Fock equation is used with a free-electron model corresponding with the Cu lattice for a more detailed calculation of the energy needed to form a vacancy. The result agrees essentially with the predicted val. (cf. *ibid.*), and a rough upper limit is found for the energy required to move a vacancy. This val. compares satisfactorily with the observed energy of activation for Cu self-diffusion. The observed anisotropy in Zn self-diffusion (cf. Banks, A., 1941, I, 201) is qualitatively explained on the vacancy process. Data for the alkali metals are insufficient. N. M. B.

Elementary theory of thermal diffusion. R. Fürth (*Proc. Roy. Soc.*, 1942, **A**, **179**, 461—469).—An approx. theory is developed which reveals the physical mechanism of the phenomenon. It leads to a formula for the diffusion ratio which accounts for many of the characteristic properties of thermal diffusion. G. D. P.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

Kinetic theory of diffusion forces in metabolising systems. H. D. Landahl (*Bull. Math. Biophysics*, 1942, **4**, 15—26).—An expression has been derived for the force on a particle in a non-uniform mixture of gases, and an attempt has been made to extrapolate the results to liquids by considering liquids as limiting cases of very dense gases. A similar expression for the force on a particle obtained on hydrodynamic grounds leads to results of the same order of magnitude. Diffusion drag forces on a diffusing solute depend chiefly on the physical properties of the solvent. C. R. H.

Statistical mechanics of many-component gases. K. Fuchs (*Proc. Roy. Soc.*, 1942, **A**, **179**, 408—432).—J. E. Mayer's theory of condensing systems is generalised for a mixture of an arbitrary no. of gases. Equations for chemical equilibrium are derived, which at low pressures reduce to the law of mass action. G. D. P.

Construction of a theory of solutions. M. Bodenstein, K. F. Bonhoeffer, and G. Joos (*Z. physikal. Chem.*, 1940, **B**, **47**, 288—290).—Criticisms of papers by Fredenhagen (A., 1938, I, 399) and Fredenhagen and Tramitz (A., 1942, I, 16). A. J. M.

Theory of solutions. IV. K. Fredenhagen and E. Tramitz (*Z. physikal. Chem.*, 1940, **B**, **47**, 291—314).—The basis of the van 't Hoff excess pressure theory is discussed, with particular reference to the criticisms of Bodenstein *et al.* (see preceding abstract). The differences between the excess pressure and the pressure defect theories are discussed. A. J. M.

Determination of mol. and ionic wts. of solutes by dialysis and free diffusion. H. Brintzinger (*Z. physikal. Chem.*, 1940, **A**, **187**, 317—334).—Reply to criticism by Jander *et al.* (*ibid.*, 13). W. R. A.

Diffusion coefficient of cupric sulphate from 0·0 to 0·35 molar at 25°. W. G. Eversole, H. M. Kindsvater, and J. D. Peterson (*J. Physical Chem.*, 1942, **46**, 370—375).—With increase in concn. (C) the decrease in diffusion coeff., which is continuous throughout the range studied, is linear with $C^{0·5}$ up to 0·0125M. C. R. H.

Rate of nucleation of silver chromate in supersaturated solutions. A. Van Hook and J. C. Ahlborn (*J. Physical Chem.*, 1942, **46**, 395—399).—An implied equation that the rate of Ag_2CrO_4 nucleation is linear in terms of supersaturation (cf. A., 1940, I, 364; 1942, I, 68) has been experimentally confirmed. C. R. H.

Radioactive investigations with solutions and powders. C. Lieseberg (*Z. physikal. Chem.*, 1940, **B**, **47**, 269—287).—The effect of the addition of sulphates and carbonates to solutions containing $Ra^{\cdot\cdot}$ has been investigated. The effect depends on whether $RaSO_4$ or $RaCO_3$ is capable of forming mixed crystals with the added substance. If this is the case there is a considerable decrease in the

radiation from the solution when the SO_4'' or CO_3'' are added. The effect is greater if $Ba^{\cdot\cdot}$ are present. The addition of $Ca^{\cdot\cdot}$, especially in the presence of SO_4'', does not cause a decrease in the radiation. The absorption of radiation by powders, especially ZnS, was also investigated. The method is of use for the detection of differences in structure of substances, where these differences are shown at the surface. Experiments with ZnS show that the addition of heavy metals in the formation of ZnS phosphors causes stuctural changes in the ZnS, since the absorption of radiation is less in the phosphor than in ZnS alone. A. J. M.

Relative viscosity of non-aqueous solutions. H. T. Briscoe and W. T. Rinehart (*J. Physical Chem.*, 1942, **46**, 387—394).—Relative η (η_0) data for solutions of $C_{10}H_8$ in C_6H_6 and in MeOH, of Ph_2 in C_6H_6, and of KI in MeOH and in glycerol (**I**) are recorded. η_0 for KI–(**I**) solutions increases and for the other solutions decreases with increasing temp. The plot of $(\eta_0 - 1)/C$ against C (C = concn.) passes through a min. in the case of the KI solutions, the effect being more pronounced at high than at low temp. for MeOH solutions and more pronounced at low than at high temp. for (**I**) solutions. C. R. H.

Diffraction of *X*-rays by liquid benzene–*cyclo*hexane mixtures. A. Eisenstein and N. S. Gingrich (*J. Chem. Physics*, 1942, **10**, 195—199).—By both the photographic and the Geiger–Müller tube methods the fine structure on the main peak and the secondary peak reported by Bell and Davey (*ibid.*, 1941, **9**, 441) could not be obtained. W. R. A.

Volatility, vapour pressures, and diffusion coefficients in the system Novolac–acetophenone. E. Jenckel and J. Komor (*Z. physikal. Chem.*, 1940, **A**, **187**, 335—353).—Mixtures of COPhMe (**I**) and a Novolac resin were confined in a small container, the lid of which had a small aperture of known diameter through which (**I**) slowly diffused. The loss in wt. per unit time $\propto$ v.p. for mixtures rich in (**I**). Volatility is related to v.p. at >70% (**I**) and to diffusion coeff. at <60% (**I**). A partial differential equation has been developed connecting these quantities in good agreement with experimental vals. W. R. A.

Analysis of the ternary system ethyl alcohol–methyl alcohol–water. J. Griswold and J. A. Dinwiddie (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 299—300).—In the method described, b.p., n, and ρ are determined, and composition is then read from a chart. L. S. T.

Thermal analyses with a hot-stage microscope. II. Contact zones. A. Kofler (*Z. physikal. Chem.*, 1940, **A**, **187**, 363—373).—The following systems have been examined microscopically at different temp. and eutectics and mol. compounds, with their thermal characteristics, are reported: NHPhAc–Ph_2; 1 : 2 : 4-$C_6H_3Me(NO_2)_2$–$C_{10}H_8$; phenanthrene–2 : 4-dinitrophenol; *s*-$C_6H_3(NO_2)_3$–β-$C_{10}H_7{\cdot}NH_2$; antipyrine–quinol; picric acid–*s*-$C_6H_3(NO_2)_3$. W. R. A.

Irregular distribution of dissolved oxygen in copper, detected by electrolytic polishing. C. Benedicks and B. Ljunggren (*Korros. u. Metallschutz*, 1940, **16**, 17—21).—"Electrolytic polishing" of Cu which has oxide inclusions leads to irregularities of the surface in the regions of high O content. The normal irregularities due to abrasion and etching are relatively easily removed by the process. The significance of the O-inclusions in the normal corrosion of Cu is discussed. J. W. S.

Lattice spacings of the primary solid solutions in magnesium of the metals of group IIIB and of tin and lead. G. V. Raynor (*Proc. Roy. Soc.*, 1942, **A**, **180**, 107—121).—Accurate measurement of the lattice spacings of the solid solutions of Al, Ga, Tl, Sn, and Pb in Mg confirm that the effect of increasing the valency of the solute atom is to tend to expand the lattice of Mg. The c-spacing–composition curve shows a change in direction at the point where an overlap of electrons from the first Brillouin zone occurs. Beyond this point the variation of axial ratio with composition $\propto$ the electron concn. The results confirm that In, Tl, white Sn, and Pb are incompletely ionised in the elementary state. G. D. P.

Solubility of sodium palmitate in organic liquids. C. W. Leggett, jun., R. D. Vold, and J. W. McBain (*J. Physical Chem.*, 1942, **46**, 429—440).—Previous data (cf. A., 1941, I, 83) have been extended to 11 additional solvents. The relation of solubility to the size, shape, and polar nature of the solvent mols. is discussed. C. R. H.

Sorption of water vapour by vermiculite and its silica. Equilibrium measurements. L. A. Spitze and L. A. Hansen (*Ind. Eng. Chem.*, 1942, **34**, 506—508).—Isotherms for the sorption of H_2O vapour by vermiculite (**I**), exfoliated vermiculite (**II**), and the activated SiO_2 derived from each have been determined at 25°, 45°, and 65°. Hysteresis was shown by both SiO_2, but not by (**I**) or (**II**). M. H. M. A.

Influence of temperature changes on efficiency of activated carbon. —See B., 1942, I, 290.

Thermal effects produced during adsorption of acetone by nitrocelluloses. E. Calvet (*Compt. rend.*, 1941, **213**, 126—128).—The heat evolved on adsorption of $COMe_2$ by nitrocellulose (**I**) containing 14% N is $\propto$ wt. of $COMe_2$ adsorbed, and amounts to 3900 g.-cal. per g.-mol. of $COMe_2$ adsorbed. The same proportionality is observed for the adsorption of $COMe_2$ on (**I**) containing 11·47% N up to the adsorption of ~3 mols. of $COMe_2$ to each C_6 chain. Gelatinisation, which commences when 1 mol. of $COMe_2$ has been adsorbed to each C_6 chain, does not affect the heat evolved, nor does the point corresponding with the fixation of 1 mol. of $COMe_2$ per NO_2. With the adsorption of >3 mols. of $COMe_2$ per C_6 there is a slight decrease in the amount of heat evolved, but at the adsorption of 6 mols. of $COMe_2$ there is a sudden decrease, corresponding with the formation of a complex hexa-acetonate of (**I**). There is a max. in the heat evolved when the wt. of $COMe_2$ adsorbed is approx. twice the wt. of the (**I**). This amounts to 88·4 g.-cal. per g. of (**I**). It is ~5 times the heat of dissolution of (**I**) (17·5 g.-cal. per g.). A. J. M.

Surface tension of micelle-forming solutions. H. M. Cassel (*J. Chem. Physics*, 1942, **10**, 246).—The min. val. of γ for soaps and other long-chain mols. in H_2O at <0·01M. is considered in the light of different theories. W. R. A.

Interfacial tension of solutions with respect to mercury. H. Dunken (*Z. physikal. Chem.*, 1940, **B**, **47**, 195—219).—The accuracy of the drop wt. method of determining surface tension is discussed, and the method is used to determine the interfacial tension of org. liquids, and mixtures of them, against Hg. At the interface between Hg and a mixture of a polar and a non-polar liquid, the non-polar liquid may be adsorbed. There are connexions between the nature of the polar groups, the positions of the atoms of the polar groups in the periodic system, and the chain length of the mol. on the one hand, and the interfacial tension of the pure substances with respect to Hg and their surface activity in the mixtures on the other. The connexion between interfacial tension and η is discussed. A. J. M.

Nomograph for the angles of liquid lenses. D. S. Davis (*Ind. Eng. Chem.*, 1942, **34**, 442—443; cf. A., 1941, I, 374).—Nomograph for obtaining α, the single segment angle of a liquid lens, from the equation: $\sin\alpha(2 + \cos\alpha)/(1 + \cos\alpha)^2 = 24v\alpha/\pi d^3$, where v and d are the mass and diameter of one segment respectively. M. H. M. A.

Amonton's law, "traces" of frictional contact, and experiments on adhesion. R. Schnurmann (*J. Appl. Physics*, 1942, **13**, 235—245).—The mechanical cleanliness of the surface of a solid in air, and the effect of adsorbed matter on the coeff. of friction, μ, are discussed. Amonton's law ($F = \mu N$) breaks down when the thickness of the adsorbed film is ~1 mol., and when the actual area of contact is a considerable fraction of the nominal area of contact. "Traces" of sliding were obtained by "developing" a glass surface, on which a metal had been sliding or rolling, with $AgNO_3$ and a reducing agent. The microscopic differences between the traces obtained for sliding and rolling are described and discussed. The traces measure the torn proportion of the area of contact. Very thin films of adsorbed matter between the high points of two solids in contact act as powerful adhesives. The jerky motion of Hg in glass capillaries is considered as a frictional phenomenon. Adhesion due to the porosity of one of the surfaces in contact is also dealt with. A. J. M.

Monolayers of compounds with branched hydrocarbon chains. V. Phthiocerol. S. Ställberg and E. Stenhagen (*J. Biol. Chem.*, 1942, **143**, 171—176).—Phthiocerol [probably $C_{31}H_{67}(OH)_2{\cdot}OMe$] forms a typical liquid-expanded monolayer on a 0·01N-HCl substrate. Its temp. of half expansion is 17° and the min. mol. area to which the monolayers can be compressed before collapse is 30—31 A.^{2} At 5° the layer is solid condensed. At 20° the apparent surface moment is 880 MD. at 122 A.^{2} but is decreased on compression to ~450 MD. at 31 A.^{2} area. Perfect multilayers could not be built and *X*-ray measurements on an imperfect 25-layer multilayer built up in Z-form indicated that this was poorly cryst. The behaviour observed is interpreted as indicating that the mol. is long with only short side-chains and with one or more polar groups near one end. J. W. S.

Proposed general structure for condensed unimolecular films. A. E. Alexander (*Proc. Roy. Soc.*, 1942, **A**, **179**, 486—499).—A brief review of existing theories of condensed monolayers is given. Experimental evidence indicates that in the least compressible region the long chains of hydrocarbons are vertically oriented and close-packed, but not so tightly packed as in the solid crystal. Between this region and the expanded state (determined only by head group dipole orientation) there is a more compressible region. The configuration at the limiting area is determined both by the orientation of the head group dipole and by the long chain packing. Known classes of condensed monolayers are grouped according to the factors thought to be responsible for determining the limiting area, viz., size of head group, H bond formation between head groups, and hydrocarbon chain packing. G. D. P.

Rôle of hydrogen bonds in condensed monolayers. A. E. Alexander (*Proc. Roy. Soc.*, 1942, **A**, **179**, 470—485).—From the behaviour of monolayers of compounds containing the –CO·NH– linking it is concluded that intermol. H bonding can play a major part in de-

termining the properties of condensed monolayers. With substituted acetamides and carbamides the H bonding is sensitive to the p_H of the substrate, very acid substrates leading to complete liquefaction, in contrast with the behaviour of the analogous acetates where no intermol. H bonding is possible. Calc. H bond distances agree with those in the crystal with the same head group. The free energy difference between the –CO·NH– group when forming H bonds to H_2O (as in the expanded film) and when cross-linked (as in the low-temp. form) is calc. to be ~840 g.-cal. per g.-mol. The importance of such measurements in determining the part played by the H bond in protein mols. is pointed out. G. D. P.

Interaction between adsorbed substances of simple constitution and insoluble monolayers. II. K. G. A. Pankhurst (*Proc. Roy. Soc.*, 1942, **A**, **179**, 393—399; cf. A., 1939, I, 367).—Penetration of monolayers of aliphatic substances and sterols by aliphatic alcohols and acids with 5—8 C is similar to that by the C_4 alcohol and acid but is much more powerful. Penetration by C_6H_4Et·OH is ≫ by PhOH. Each CH_2 added to the hydrocarbon chain decreases the concn. required for equal penetration by a factor of ~4·5. The penetration is non-sp. and only destroys the cohesion of the monolayer. A sensitive single wire surface balance is described. G. D. P.

Highly purified colloids. (From electrodialysis to electrodecantation.) W. Pauli (*Helv. Chim. Acta*, 1942, **25**, 137—161).—A review. F. J. G.

Gold sol. I. Instability in gold sols. H. R. Kruyt and J. G. Vogel (*Kolloid-Beih.*, 1940, **52**, 87—164).—Automatic apparatus for the dispersion of Au by Bredig's method is described. An equilibrium concn. of ~0·3% Au is reached, but further concn. up to ~1·5% Au can be effected by electrodecantation, ultrafiltration, etc. The more conc. sols are unstable, and their instability increases with progressive removal of the HCl used as the dispersion medium. Sols prepared by dispersion in very pure H_2O are completely unstable. HCl-dispersed sols, of whatever concn., undergo a coarsening, which *X*-ray examination shows to be due to aggregation of the original particles. The coarsened sols are, or can be made, stable, and behave normally towards electrolytes. Coarsening is produced by Cl′, Br′, and by complex ions containing them only in an acid medium, whereas the coarsening due to I′ is independent of the medium. The causes of the phenomenon are discussed, and an explanation based on the preferential discharge of stabilising ions at certain positions on the particles is put forward. F. L. U.

Structure and capacity of electrical double layer. J. J. Bikerman (*Phil. Mag.*, 1942, [vii], **33**, 384—397).—In an inhomogeneous field substances of high dielectric const. accumulate where field intensity is max. This property determines the distribution of ions and solvent mols. competing for positions near an interface. For Hg–solution interfaces the theory accounts for the shape of capacity–potential curves, and confirms Gouy's vals. for low potentials and concns. At high potentials the thickness of the equiv. double layer is equal to the distance between the charges in the resultant dipole. L. J. J.

Diffusion as a function of aggregation in colloidal media. H. Branson (*Bull. Math. Biophysics*, 1942, **4**, 1—6).—Assuming that adsorption is a simple function of surface area, a simple diffusion equation has been deduced from a mathematical consideration of the dependence of the diffusion coeff. of an adsorbable solute on the degree of aggregation of the adsorbing colloid. C. R. H.

Variations in the electrochemical properties of hydrogen-clay sols with temperature. B. Chatterjee and A. Sen (*J. Indian Chem. Soc.*, 1941, **18**, 646—647).—Unlike SiO_2 sols and H-bentonite sols (Mukherjee *et al.*, A., 1942, I, 57), H-clay sols show an increase in degree of dissociation between 1° and 50°. F. R. G.

Electrochemical properties of silicic acid sols. III. Variations in the p_H, specific conductivity, and total acidity of silicic acid sols with dilution and with temperature. B. Chatterjee and A. Sen (*J. Indian Chem. Soc.*, 1942, **19**, 17—24).—The free and total acidities of silicic acid sols change linearly with concn. but are const. from 1° to 50°. Their degree of dissociation is independent of concn. and temp. (1—50°). The sp. conductivity increases linearly with temp., coeff. 2% at 18°. D. F. R.

Viscosity of "ferric oxide" hydrosols. L. M. Greenstein and A. W. Thomas (*J. Chem. Physics*, 1942, **10**, 229—240).—Changes in η of "ferric oxide" hydrosols on ageing, heating, addition of electrolytes and non-electrolytes, and the corresponding changes in p_H and sp. conductances (κ) have been investigated. Poiseuille's law holds for cationic and anionic hydrosols. η decreases and κ increases with ageing and with heating. Addition of salts and acids causes a primary decrease in η followed by an increase at higher concns. which occurs at salt or acid concns. which are the lower, the greater is the pptg. power of the salt or acid. η of cationic hydrosols is decreased more by salts than by acids. Explanations are advanced. W. R. A.

Relation between viscosity of solutions and physical properties of high polymerides. R. Simha (*J. Appl. Physics*, 1942, **13**, 147—153).—A review and discussion of the effect of mol. shape on η in solutions of high polymerides. The correlation of η and sedimentation data, the relation between mol. wt., shape, and internal friction, and the effects of mol. orientation and flexibility are discussed. A. J. E. W.

Frictional phenomena. VIII. A. Gemant (*J. Appl. Physics*, 1942, **13**, 210—221).—The η of colloidal systems varies with stress owing to gel formation. In such systems the rate of shear does not vary linearly with stress for stationary flow, and there is a finite relaxation process for suddenly applied stresses or deformations. For vibrational processes, the dynamic η is dependent on frequency. The chief experimental facts bearing on these points are reviewed. A. J. M.

Relaxation effects in amorphous media. R. Simha (*J. Appl. Physics*, 1942, **13**, 201—207).—The Maxwell relaxation theory is developed and extended to systems composed of several viscous-elastic components with different relaxation times, or of high-polymeric materials having a continuous relaxation rate distribution. A. J. E. W.

Orientation of micelles in soap fibres. S. Ross (*J. Physical Chem.*, 1942, **46**, 414—417).—Discussion. C. R. H.

Swelling pressure and sorption hysteresis in gels.—See B., 1942, I, 305.

Heat of coagulation of silica and its bearing on the structure of silica gels. A. R. Tourky (*Chem. and Ind.*, 1942, 254—255).—The heat of coagulation of SiO_2 gel under the influence of HCl varies from ~148 g.-cal. per g. of SiO_2 where the amount of HCl is just sufficient to make the solution neutral to ~336 g.-cal. per g. of SiO_2 where the final p_H is 2—3. The data are discussed with reference to those of other workers and to the general theory of gel structure. C. R. H.

Electrophoresis of the chlorophyll–protein complex.—See A., 1942, III, 554.

Migration of colloids through the interface between immiscible liquids under the influence of an electric field, and the formation of ultra-colloids. G. E. Gibson and L. Baldwin (*J. Chem. Physics*, 1942, **10**, 247—248).—In the two-phase system H_2O–$COMe_2$–Et_2O in a U-tube with electrodes dipping in the Et_2O-rich phases, colloidal As_2O_3, Au, C, and bentonite clay traverse the interface on applying an e.m.f. (~200 v. for As_2S_3 if Et_2O only slightly in excess; otherwise >200 v.). Viewed through the ultra-microscope the colloid particles perform violent motions soon after the e.m.f. is applied. After some time a dark band, presumably the region of high potential gradient, develops in the Et_2O-rich layer and in it is formed an extremely fine colloid. The violence of the motions of colloid particles is diminished by careful dialysis to remove electrolytes. W. R. A.

VI.—KINETIC THEORY. THERMODYNAMICS.

Pressure dependence of the equilibrium constant of ammonia. K. Fuchs (*Proc. Roy. Soc.*, 1942, **A**, **179**, 433—438).—A theoretical investigation of the chemical equilibrium of a slightly imperfect gas is made. At high temp. the consts. in the formula can be expressed in terms of the van der Waals consts. Numerical results for NH_3 are in good agreement with experiment. G. D. P.

Dielectric polarisation and association of alicyclic alcohols. W. Hückel and I. Schneider (*Z. physikal. Chem.*, 1940, **B**, **47**, 227—244).—The variation of the orientation polarisation with concn. is studied for *sec.* alicyclic alcohols dissolved in C_6H_6 and in *cyclo*hexane. For alcohols with considerable steric hindrance (*e.g.*, α-fenchol, *trans*-β-decalol) orientation polarisation falls steadily with concn. For low concns. the association determined by the cryoscopic method and the orientation polarisation vary together if the association is to double mols. with no moment. For alcohols showing no steric hindrance the variation of orientation polarisation with concn. is quite different, and can be explained only on the assumption of a chain association to double mols. and quadrupole double mols. at low concns. A. J. M.

Complex formation in aqueous mercuric chloride and potassium iodide by conductivity, viscosity, and refractivity measurements. D. N. Solanki and B. G. Joshi (*J. Indian Chem. Soc.*, 1942, **19**, 9—16).—The occurrence of max. or min. in sp. conductivity–, n–, and η–composition curves suggests the existence of $10KI,HgCl_2$, $20KI,3HgCl_2$, and 4—$5KI,HgCl_2$. D. F. R.

Base strength of arsine oxides and analogous compounds from the nitrogen and sulphur groups. P. Nylén (*Z. anorg. Chem.*, 1941, **246**, 227—242; cf. A., 1938, I, 250).—Vals. of p_{K_A} (20°) for the corresponding acids formed by proton addition, determined by potentiometric titration with aq. NaOH, are: $AsMe_3O$ 3·75, $AsEt_3O$ 3·71, $SbMe_3O$ 5·36, $SeMe_2O$ 2·55, $TeMe_2O$ ~6. PMe_3O and Et_2SO are less basic than H_2O; relative vals. of p_{K_B} (25°) in anhyd. $EtCO_2H$ [S. Terjesen] are PMe_3O 3·12, Et_2SO 3·69 (NH_2Ac 3·12). The dissociation and mechanism of hydrolysis of $AsMe_3Br_2$, $AsEt_3Br_2$, and $SbMe_3Br_2$ are discussed with reference to potentio-

metric titration data. The structures of $SMe_3 \cdot NO_3$ and of additive compounds of sulphoxides and HNO_3 are also discussed. A. J. E. W.

General theory of the isoelectric point. T. L. Hill (*J. Physical Chem.*, 1942, **46**, 417—428).—Mathematical. The treatment of the problem is extended to solutions of any no. of ampholytes. C. R. H.

Carbonate effect in the titration of magnesium chloride with alkali hydroxide. R. Näsänen (*Z. physikal. Chem.*, 1942, **A**, **190**, 183—194).—The effect of the equilibrium $Mg^{\cdot\cdot} + HCO_3' \rightleftharpoons MgHCO_3^+$ on the titration of $MgCl_2$ with alkali is discussed theoretically, and data are presented in support of derived equations. The solubility product of $Mg(OH)_2$ in NaCl solutions has been determined (cf. *ibid.*, 1941, **A**, **188**, 272). C. R. H.

Departure of the equivalence volume from the inflexion volume in potentiometric titrations. II. I. G. Murgulescu and C. Drăgulescu (*Z. physikal. Chem.*, 1942, **A**, **190**, 174—182; cf. A., 1940, I, 230).—Theoretical. More accurate expressions are derived from a consideration of ionic activity coeffs. C. R. H.

Temperature–composition diagram of the partly miscible system water–*iso*butyl alcohol. J. J. Jasper, C. J. Campbell, and D. E. Marshall (*J. Chem. Educ.*, 1941, **18**, 540—542).—A method of obtaining data for such systems is described. L. S. T.

Freezing of binary mixtures. Schatzman (*Compt. rend.*, 1941, **213**, 124—126).—The form of the apparent solidus curve obtained when a binary mixture is cooled too rapidly for the attainment of thermodynamic equilibrium is discussed from the theoretical viewpoint. It is assumed that the solid is heterogeneous, the liquid is homogeneous and is in equilibrium with the surface layer of the solid, and that there is no diffusion. The cases of isodimorphism with eutectic, and isomorphism with and without a min., are considered. A. J. M.

Solubility diagram for the system benzene–pyridine–water. J. C. Smith (*J. Physical Chem.*, 1942, **46**, 376—380).—Data at 25° are presented in tabular and triangular diagrammatic form. The anomaly reported by Woodman and Corbet (cf. A., 1926, 19) is confirmed. C. R. H.

Ternary system lithium chloride–dioxan–water. C. C. Lynch (*J. Physical Chem.*, 1942, **46**, 366—370).—Data at 25° are presented in tabular and triangular diagrammatic form. $LiCl,H_2O,(C_2H_4)_2O_2$ has been prepared. C. R. H.

Heats of dissolution of the alkali hydrosulphides and hydroselenides, and some derived magnitudes. W. Teichert and W. Klemm (*Z. anorg. Chem.*, 1941, **246**, 3—13).—Heats of dissolution at 0° are recorded as follows: NaHS, 3·6; NaHSe, 4·1; KHS, 0·1; KHSe, −1·2; RbHS, 0·0; RbHSe, −2·0; CsHS, −0·4; CsHSe, −2·9 kg.-cal. per g.-mol.; and at 20°: NaHS, 4·5; KHS, 0·7 kg.-cal. per g.-mol. These vals. are > but parallel to those for the bromides and iodides, just as the vals. for the hydroxides are > but parallel to those for the fluorides. From the data other magnitudes are calc. as follows. Heats of formation: NaHS, 57·1; NaHSe, 30·4; KHS, 63·2; KHSe, 38·3; RbHS, 64·1; RbHSe, 39·9; CsHS, 65·7; CsHSe, 42·0 kg.-cal. per g.-mol.; heats of hydration: HS', 83; HSe', 76 kg.-cal. per g.-mol.; these are > the vals. for the comparable halide ions, owing to the effect of the dipole. The electron affinities of the HS and HSe groups are 53 and 44 kg.-cal. per g.-mol., and the proton affinities of the HS' and HSe' ions are 346 and 341 kg.-cal. per g.-mol. The former are <, and the latter >, the vals. for the corresponding halogen atoms or ions. F. J. G.

Heats of mixing in the ternary system ethanol–acetic acid–ethyl acetate by a rapid approximate method. B. Longtin (*J. Physical Chem.*, 1942, **46**, 399—405).—The method, which has an accuracy of ~5 joules per mol., is described and illustrated with data for the system EtOH–AcOH–EtOAc. C. R. H.

Thermochemical investigation of the rotation of C–C bonds. G. Jung and J. Dahmlos (*Z. physikal. Chem.*, 1942, **A**, **190**, 230—240).—From vals. for the heat of combustion of the reactants, the difference between the heats of reaction between glycol (**I**) and $COMe_2$ and between *cis-cyclo*pentanediol (**II**) and $COMe_2$ has been calc. The val. of the difference (~1·9 kg.-cal.) as an indication of the relative potential energies of the OH groups in (**I**) and (**II**) is discussed. C. R. H.

Heat of coagulation of silica.—See A., 1942, I, 266.

VII.—ELECTROCHEMISTRY.

Action of an electric field at the surface of an electrolyte. C. Cassignol (*Compt. rend.*, 1941, **213**, 868—870).—When there is a sufficiently great potential (50—80 v.) between the electrodes in electrolysis, light is emitted, usually from the electrode with the smaller surface. The voltages necessary are insufficient to cause disruptive discharge or thermionic emission. The carriers of the discharge are charges emitted by the electrolyte. A. J. M.

Relationships between standard electrode potentials of the elements and their positions in the periodic table. C. L. Deasy (*J. Chem. Educ.*, 1941, **18**, 514).—Eight relationships are pointed out. L. S. T.

Calculated and observed values of the electrode potential of ozone. E. Briner (*Helv. Chim. Acta*, 1942, **25**, 98—106).—E_0 for O_3 is calc. to be 2·07 v. at 20°. F. J. G.

Potential of the zinc–cadmium eutectic. M. Straumanis and N. Brakšs (*Korros. u. Metallschutz*, 1940, **16**, 27—33).—Measurements on electrodes of Zn–Cd eutectic alloy (17 wt.-% Zn) in various electrolytes indicate that the electrode potential tends to approach the Zn electrode potential as the rate of dissolution of the metal becomes vanishingly small, attaining such val. only in neutral solution and in the absence of air or other oxidising agent. It is inferred that in general, alloys comprising two immiscible metals will show the potential corresponding to the more electropositive component. When the rate of dissolution of the metal is appreciable, the [Zn] in the alloy is decreased, or if it is etched, the electrode potential is decreased. J. W. S.

Activation and passivation potentials in passivity phenomena. V. Čupr (*Korros. u. Metallschutz*, 1940, **16**, 10—17; cf. A., 1937, I, 141).—The self-activation of a passive Cr or Fe–Cr electrode occurs at a definite potential which is more positive than the potential required for cathodic activation of the same electrode by application of an external e.m.f. Similarly the self-passivation potential produced by atm. O_2 or O_3 is more negative than the potential required for anodic passivation. These results are discussed theoretically with reference to the effects of p_H, temp., nature of the anion present, the presence of oxidising or reducing agents, and the rate of change of the polarising potential. J. W. S.

Electrochemistry of baths of fused aluminium halides. I. Aluminium as a reference electrode. R. G. Verdieck and L. F. Yntema. **II. Deposition potentials of chromium, molybdenum, and tungsten.** E. E. Marshall and L. F. Yntema (*J. Physical Chem.*, 1942, **46**, 344—352, 353—358).—I. The Al electrode can be used as a reference electrode in studying diffusion potentials of metals from alkali chloride–$AlCl_3$ baths. Deposition and decomp. potentials for several metals are tabulated, the sum of the two potentials being 2·09±0·04 v. Co is abnormal.

II. Extension to Cr, Mo, and W has shown that deposition potentials of solutions of Mo^{III} and W^{III} are the same as for solutions of Mo^{VI} and W^{VI}, suggesting that reduction to the tervalent state precedes deposition in each case. C. R. H.

Oxidation–reduction potential of the system hæmoglobin–ethyl hydroperoxide. M. Polonovski, M. F. Jayle, and (Mlle.) G. Fraudet (*Compt. rend.*, 1941, **213**, 887—889).—EtO_2H oxidises the Fe of hæmoglobin to $Fe^{\cdot\cdot\cdot}$, but the instability of the oxidised compound and its inability to form a more highly oxidised derivative distinguish it from methæmoglobin (**I**). The enzymic activity is also different from that of (**I**). Hæmoglobin is thus more than a reservoir of O, and participates in biological oxidations by its enzymic activity. A. J. M.

Contact potentials. I. General principles. II. Volta effect. J. A. Chalmers (*Phil. Mag.*, 1942, [vii], **33**, 399—415, 416—430).—I. Definitions of terms are considered, and it is shown that the sum of the interphase p.d. is equal to the measured p.d. of the complete system.

II. The chemical and contact theories of the Volta effect are considered, and it is shown that the two theories can be reconciled if care is taken in definitions. Replacement of a vac. by a dielectric does not alter the Volta effect. The ionisation method of approaching the problem gives identical results with other methods. The relationship of the Volta effect with the Peltier effect and the photo-electric work function is discussed. A. J. M.

Origin of hydrogen overpotential. S. von Náray-Szabó (*Korros. u. Metallschutz*, 1940, **16**, 22—27).—Theories of the overpotential (η) of H are summarised and discussed critically. Experiments with Hg, Ag, Cu, and Pt electrodes in HCl and H_2SO_4 indicate that Tafel's relation $\eta = a + b \log c$ (c = cathodic c.d.) holds within experimental error and that the consts. a and b vary with the metal and electrolyte. The importance of H-adsorption in overpotential phenomena is emphasised. J. W. S.

Mechanism of overvoltage of azide and hydroxyl ions. R. Audubert and E. T. Verdier (*Compt. rend.*, 1941, **213**, 870—873).—A general equation for anodic overvoltage applies also to N_3' and OH'. A. J. M.

Theory of corrosion phenomena. XVIII. Principles of the electrochemical interpretation of corrosion processes by local cells. W. J. Müller (*Korros. u. Metallschutz*, 1940, **16**, 1—10).—The principles underlying the author's theory are discussed. The importance of the course of the c.d.–potential curves of various cells and the contributions made by the Nernst potential, overpotential, and cathodic film polarisation are emphasised and applied to the behaviour of local corrosion cells. J. W. S.

Behaviour of tocopherols at the dropping of mercury electrode.—See A., 1942, II, 235.

Amperometric titration of α-tocopherol with auric chloride at the dropping mercury electrode.—See A., 1942, III, 554.

Application of the dropping mercury electrode to the investigation of polyhydroxy-acids and lactones. H. Matheson, H. S. Isbell, and E. R. Smith (*J. Res. Nat. Bur. Stand.*, 1942, **28**, 95—131).—Polarographic measurements in the presence of NEt_4Cl show that freshly prepared solutions of aldonic acids give the usual H-wave but no wave corresponding with the reduction of the CO_2H group. After keeping, however, the H-wave decreases and a wave due to the γ-lactone appears. In the presence of O_2 a wave, apparently caused by a product of interaction of the acid with Hg and O_2, occurs at ~−1·1 v., with accompanying decrease in the H-wave. Freshly prepared solutions of the δ-lactones of aldonic acids give waves at ~−2·3 v. apparently due to reduction of the lactones. These waves disappear when the solution is kept. The γ-lactones of aldonic acids yield waves at potentials slightly > that of the δ-lactones and on keeping their solutions the wave due to the lactone decreases in height and that due to H appears. When OH on $C_{(2)}$ and the residual C-group on $C_{(4)}$ are in *cis* positions the reduction potential of the γ-lactone is > when these groups are in *trans* positions. J. W. S.

Temperature correction devices in ion concentration measurements. F. Lieneweg (*Z. tech. Physik*, 1942, **23**, 12—16).—The theory of the effect of temp. on the e.m.f. of cell combinations used for ion concn. measurements, and its application to the design of automatic temp.-compensating devices, are discussed. With compensated glass and Sb electrodes (cf. Fischbeck and Eimer, A., 1939, I, 94; Spychalski, *ibid.*, 533) p_H errors may attain 0·1 for a temp. change of 15°, unless experimentally determined corrections are applied. A. J. E. W.

VIII.—REACTIONS.

Low-temperature oxidation of nitric oxide. L. S. Gibianski and S. Z. Roginski (*J. Phys. Chem. Russ.*, 1940, **14**, 1347—1351).—To SiO_2 gel definite vols. of O_2, of NO, or of O_2 + NO are admitted. The pressure decrease of a NO–O_2 mixture is > the sum of these decreases for O_2 and NO, showing that NO_2 is formed and is practically completely adsorbed by the gel. Thus determined, the rate of formation of NO_2 is very small at low pressures and steeply rises to a const. val. at the threshold pressure *p*. For O_2 25, NO 75 *p* has a min. val. (0·25 mm. Hg at 194° K.); it rises slightly when $[O_2]$ decreases, and steeply when $[O_2]$ increases. For O_2 33, NO 67 *p* rises from 0·08 mm. Hg at 178° K. to 1·95 at 273° K. The activation energy near *p* is 2200 g.-cal. Probably some chain mechanism is responsible for the existence of the threshold. At higher pressures SiO_2 accelerates the NO_2 formation, *e.g.*, 30-fold at 235° K. when the gases are dry. J. J. B.

Kinetics of oxidation of ethylenic hydrocarbons. C. Paquot (*Compt. rend.*, 1941, **213**, 130—131).—A reply to criticism (cf. Amiel, *ibid.*, **212**, 956). A. J. M.

Limits of inflammability and ignition temperature of styrene in air. G. W. Jones, G. S. Scott, and W. E. Miller (*U.S. Bur. Mines*, 1942, *Rept. Invest.* 3630, 5 pp.).—At the lower and upper limits of inflammability dry air–styrene (I) mixtures contain 1·10 and 6·10% of (I) respectively. The ignition temp. of (I) is 490° in air and 450° in O_2. C. R. H.

Reversible transformation of chloro- and aquo-pentammine cobaltic chlorides in dilute hydrochloric acid solutions. B. Adell (*Z. anorg. Chem.*, 1941, **246**, 303—328; cf. Sandved, A., 1935, 587).—The equilibrium $[Co(NH_3)_5Cl]^{··} + H_2O \rightleftharpoons [Co(NH_3)_5H_2O]^{···} + Cl'$ has been studied by optical extinction, potentiometric titration, and electrometric methods with 0·005—0·01M. solutions of the complexes in 0·001—0·0001M-HCl, at 25°. *k* vals. are calc. on the assumption that the forward change is unimol. and the reverse change bimol.; the data can be treated as if both changes were unimol., but only because the forward change predominates. The effect of ionic strength on the *k* vals. is examined. A. J. E. W.

Determination of esterification constants in presence of a neutral solvent.—See A., 1942, II, 215.

Displacement reactions in neopentyl halides.—See A., 1942, II, 245.

Rates of reduction of aneurin and diphosphoaneurin. Effect of aneurin on condensation reactions of pyruvate.—See A., 1942, III, 470.

Kinetics of topochemical reactions. O. M. Todes (*J. Phys. Chem. Russ.*, 1940, **14**, 1224—1228).—The rate of growth of a solid reaction product within a solid reactant is calc. for various sizes and shapes of solid particles. J. J. B.

Some problems of topokinetics. B. V. Erofeev (*J. Phys. Chem. Russ.*, 1940, **14**, 1217—1223).—There are two kinds of reaction in which a solid gives solid products. In (1) the no. of nuclei of the product originating per unit time is const., and the radius of a nucleus grows at a const. speed. The total speed of reaction is calc. for plane, linear, and point nuclei. In (2) the rate of reaction increases exponentially with time. This type is due to "infection" of neighbouring crystals by a nucleus. The difference between this explanation and the theory of chain reactions is emphasised; chains are possible only for exothermal reactions whereas "infection" is independent of the heat of reaction and is observed, *e.g.*, in the thermal decomp. of $(HCO_2)_2Co$ + 1% $(HCO_2)_2Mn$ at 218°, which is endothermic. J. J. B.

Parabolic and logarithmic oxidation of copper.—See B., 1942, I, 312.

Polymerisation of ethylene and propylene by free alkyl radicals. O. Beeck and F. F. Rust (*J. Chem. Physics*, 1941, **9**, 480—483).—Me- and Et-induced polymerisation of C_2H_4 and C_3H_6 at 350—450° proceeds by successive addition of olefine mols. to radicals. Formation of long-lived C_3H_5 radicals causes a much lower polymerisation in C_3H_6 than in C_2H_4. L. J. J.

Effect of sodium sulphate in basic chrome sulphate tanning.—See B., 1942, II, 246.

Investigation of the mechanism of catalytic reactions by means of artificially radioactive indicators. N. E. Breshneva (*J. Phys. Chem. Russ.*, 1940, **14**, 1371—1373).—When C_6H_6 reacts with Br in presence of $ZnBr_2$ containing radioactive Br the progress of the bromination is quite different from that of the exchange between Br and radioactive $ZnBr_2$. The energy of activation of the bromination is 6200 g.-cal. and of the exchange 18 kg.-cal. For the isomerisation 1-→2-$C_{10}H_7Br$ in presence of $AlBr_3$ it is 8 kg.-cal. and for the exchange in this case 20 kg.-cal. J. J. B.

Relationship of the stages of heterogeneous catalysis. S. J. Elovitsch (*J. Phys. Chem. Russ.*, 1940, **14**, 1176—1181).—The first stage of any heterogeneous catalysis is diffusion of the reactant mols. to the catalyst; since the diffusion usually has a smaller temp. coeff. than the real rate of reaction, it often determines the total rate of reaction at high temp. The next step is activated adsorption, mostly leading to formation of an intermediate compound. Activated adsorption alone is not enough, as Ni saturated with C_2H_4 does not react with H_2, and Ni saturated with H_2 does not react with C_2H_4. J. J. B.

Electrochemical methods of studying the surface of catalysts. A. N. Frumkin (*J. Phys. Chem. Russ.*, 1940, **14**, 1200—1207).—Electrochemical charging of metal electrodes with H_2 or O_2 gives information about the surface of metals; a review of the results thus obtained is given. J. J. B.

Para–ortho transformation of hydrogen and exchange between light and heavy hydrogen on charcoal. R. Burschtein (*J. Phys. Chem. Russ.*, 1940, **14**, 1195—1199).—The para–ortho transformation in presence of C at a low temp. θ_1 is retarded if the C has previously absorbed H_2 at a higher temp. θ_2. When θ_1 and θ_2 remain const. the retardation ∝ the amount adsorbed. The retardation is the larger the lower is θ_1 (−183° to 27°) and θ_2 (300—700°). The smaller retarding effect of H_2 adsorbed at higher temp. is attributed to the possibility of H_2 occupying at high temp. surface spots requiring a higher activation energy of adsorption, these spots being less efficient as catalysts. The relative area of these spots and the activation energy of adsorption on these and on catalytically active spots are calc. The H_2 adsorbed at 500° retards also the exchange between light and heavy H at room temp. This effect shows that the adsorbed H_2 remains on the surface of the charcoal without penetrating into its lattice. If the para–ortho transformation or the H_2–D_2 exchange takes place at a temp. at which the activated absorption occurs, the latter poisons the catalyst. The rate of the transformation on active C is independent of the gas pressure and has a positive temp. coeff.; on poisoned C it ∝ the pressure and has a negative temp. coeff. J. J. B.

Catalytic combustion on surfaces. M. B. Ravitsch (*J. Phys. Chem. Russ.*, 1940, **14**, 1353—1361).—The rate *r* of combustion of the mixture O_2 + $2H_2$ at 400° in a SiO_2 tube is low and is raised by a SiO_2 filling > by a fireclay filling. At 900° *r* in the presence of fireclay is > in the presence of SiO_2. The activity of fireclay is increased by 10% of NiO or of iron oxides + 0·1% of K_2O + 0·2% of Al_2O_3; *r* becomes at 400° equal to that on pure fireclay at 900°. The mineral dunite, fireclay containing 10% of ThO_2 and 0·1% of Ce_2O_3, and fireclay containing pure or crude Ce oxides afford equal vals. of *r* at 500°. V_2O_5 improves fireclay less. The combustion on surfaces is used on a semi-large scale in boilers and furnaces. If the fuel contains only C, H, O, and N, the combustion product contains only wholesome gases (no CO) and can be used for producing a neutral atm. J. J. B.

Mechanism of the oxidation of sulphur dioxide on oxide catalysts. G. K. Boreskov (*J. Phys. Chem. Russ.*, 1940, **14**, 1337—1346).—The activity of an Fe oxide catalyst decreases below 625°, and the composition of the catalyst is Fe_2O_3 above 625° and $2Fe_2O_3,3SO_3$ below 600°. As Neumann and Heintke (A., 1937, I, 315) attributed the change of activity at 625° to the dissociation pressure of $Fe_3(SO_4)_4$ which is not present in the catalyst, their theory is disproved. Contrary to Neumann, $VOSO_4$ cannot be the intermediate product in the oxidation of SO_2 on V_2O_5 since the rate of formation

of $VOSO_4$ is too low. The mixture V_2O_5 1, Na_2SO_4 0·1 mol. shows a max. activity at 505°. The mixture V_2O_5 1, Na_2SO_4 0·1, SiO_2 8 mols. is a very active catalyst; its activity at 400—470° depends on whether this range was arrived at by heating or by cooling. J. J. B.

Optical investigations of activated adsorption. A. N. Terenin (*J. Phys. Chem. Russ.*, 1940, **14**, 1362—1369).—The absorption spectrum (*e.g.*, of I or NO_2) is only little changed by adsorption on SiO_2 gel. The rate r of decomp. of NH_3 in light is affected by adsorption; on unactivated Al_2O_3 there is a broad max. of r between 2000 and 2400 A., and on activated Al_2O_3 two max. of r (2200 and 2900 A.) are observed. The longest wave causing decomp. of $COMe_2$ is 1950 A. in the gas phase and 2200 and 2800 A. for $COMe_2$ adsorbed on unactivated and activated Al_2O_3, respectively. The Raman spectrum cannot be used for studying activated adsorption. The absorption of NH_3 in the ultra-red is not affected by adsorption on SiO_2 but the band is shifted to lower frequencies when Fe from $Fe(CO)_5$ is the adsorbent. The photochemical decomp. of MoO_3 and $PbCl_2$ is accelerated by adsorption of NH_3, NH_2Ph, or PhCHO. J. J. B.

Kinetics of ammonia synthesis. V. A. Roiter (*J. Phys. Chem. Russ.*, 1940, **14**, 1229—1240).—The rate y of synthesis referred to 1 c.c. of catalyst is related to the total pressure P, the H_2 pressure p_1, the N_2 pressure p_2, and the time τ of contact with the catalyst by the equations $y = kP^{1.25}$, $y = k_1p_1$ (p_2 being const.), $y = k_2p_2^{0.5}$ (p_1 being const.) at pressures <1 atm., and by the equations $y = k_\tau^{-0.6}P^{1.6}$, $y = k_1p_1^{1.4}$, and $y = k_2p_2^{0.5}$ at 50—200 atm. These equations are empirical and cannot be exact as the sum of the exponents of p_1 and p_2 is not equal to that of P. No mechanism suggested so far accounts for these rules but the theory of Temkin and Pishev (cf. A., 1942, I, 207) is the most promising. J. J. B.

Kinetics of ammonia synthesis. M. I. Temkin (*J. Phys. Chem. Russ.*, 1940, **14**, 1241—1245).—The rate of NH_3 synthesis is determined by the rate of adsorption of N_2, and that of NH_3 decomp. by the rate of desorption of N_2. This mechanism gives for the rate of synthesis $v_1 = k_1p_1p_2^{1.5}/p_3$ and for the rate of decomp. $v_2 = k_2p_3/p_2^{1.5}$, p_1, p_2, and p_3 being the pressures of N_2, H_2, and NH_3, respectively. These equations are in a sufficient agreement with experiment (cf. preceding abstract). J. J. B.

Decomposition of carbon monoxide by ferromagnetic metals. F. Olmer (*J. Physical Chem.*, 1942, **46**, 405—414).—Of several metals examined only Fe, Ni, and Co catalyse the decomp. of CO, decomp. beginning at 300—400°. Fe_3C is catalytically inactive. The catalytic properties of Fe are weakened at 580—590° as a result of agglomeration of Fe particles with a consequent reduction of surface available for CO adsorption. Dilution of Fe with neutral substances, *e.g.*, MgO, hinders agglomeration, and the activity of such diluted Fe is less affected by heating through the agglomeration temp. region. C. R. H.

Mechanism of the catalytic oxidation of carbon monoxide on manganese dioxide. N. Schurmovskaja and B. Bruns (*J. Phys. Chem. Russ.*, 1940, **14**, 1183—1192).—The catalytic activity of MnO_2 prepared by electrolysis gradually decreases if MnO_2 is kept in CO or used for accelerating the oxidation in CO–O_2 mixtures; in about a day a const. activity is reached. When the catalyst is in this steady state, the rate of oxidation $\propto$ [CO] and is independent of [O_2]. The initial activity is restored by O_2 at 180—200°. The activation energy at low temp. (0—50°) is 1500 g.-cal. for a fresh catalyst, and 2500 g.-cal. for MnO_2 in the steady state. At higher temp. (50—70°) the energy of activation is 12,000 g.-cal. Probably above 50° new active spots form on the surface of the catalyst. To elucidate the mechanism of the reaction CO and O_2 were admitted to MnO_2 separately. The formation of CO_2 takes place after admission of CO, showing that CO reduces MnO_2 and that the product of reduction is oxidised by O_2. MnO_2 absorbs O_2 ~3 times as rapidly as CO. J. J. B.

Kinetics of heterogeneous catalytic processes. M. I. Temkin (*J. Phys. Chem. Russ.*, 1940, **14**, 1153—1158).—The surface of solid catalysts is not uniform. If a simple assumption is made about the relation between the area over which the adsorption coeff. is a, and the magnitude of a, then the occupied fraction of the surface is $[\log_e(1 + a_0p) - \log_e(1 + a_1p)]/[\log_e a_0 - \log_e a_1]$, p being the gas pressure and a_0 and a_1 the greatest and the smallest val. of a. The rate of a reaction on such a surface $\propto (a_0p)^\beta$, β being the ratio of the changes of the activation energy of the reaction to those of the adsorption energy on movement from an active spot to one next to it in activity. Since β is <1, the rate of many heterogeneous reactions is $< \propto p$. The theory is applicable to the discharge of ions, and in particular to overvoltage. Analogous equations can be deduced assuming the surface to be uniform but considering the repulsive forces between adsorbed mols. J. J. B.

Catalytic oxidation of acetylene. V. A. Roiter (*J. Phys. Chem. Russ.*, 1940, **14**, 1370).—$AgMnO_4$ deposited on a Mn ore is a powerful catalyst for atm. oxidation of traces of C_2H_2 at 160°; it can be used for 10^{-3}—10^{-4}% of C_2H_2 in air; concns. of 10^{-2}% poison this catalyst and require employment of activated MnO_2. J. J. B.

Catalytic hydrogenation and polymerisation of acetylene–hydrogen mixtures.—See A., 1942, II, 213.

Catalytic dimerisation of ethylene.—See A., 1942, II, 213.

[Catalytic] dehydrogenation of open-chain hydrocarbons in presence of carbon dioxide.—See A., 1942, II, 213.

Catalytic dehydrogenation of butane.—See A., 1942, II, 213.

Catalytic aromatisation of paraffin hydrocarbons.—See A., 1942, II, 252.

Catalytic isomerisation of monocyclic hydrocarbons in presence of molybdenum disulphide.—See A., 1942, II, 220.

Vanadium catalytic masses in manufacture of sulphuric acid.—See B., 1942, I, 298.

Structure and properties of heterogeneous catalysts. A. M. Rubinstein (*J. Phys. Chem. Russ.*, 1940, **14**, 1208—1216).—The apparent energy of activation of dehydrogenation of alcohols on mixed catalysts containing $Ni : Al_2O_3 = 1 : 1$ is 0·55 of the activation energy of dehydration of the same alcohols on the same catalysts; hence dehydration and dehydrogenation take place on different active spots which probably are localised along phase boundaries. The efficiency of Ni–Al_2O_3 catalysts is max. at $Ni : Al_2O_3 = 1 : 1$. The ratio of the activation energies dehydrogenation : dehydration is 0·35 for Pt on charcoal, and 0·40 for Pt on Al_2O_3; it is 1 for the unmixed catalysts Fe_2O_3 and ZnO and <1 for Cr_2O_3 and BeO since these catalysts cause carbonisation of alcohols. Dehydrogenation of alcohols in presence of Ni–Al_2O_3 catalysts is most rapid when the Ni crystals are 70—80 A. in diameter; the range investigated was 30—130 A., and the sharpness of *X*-ray lines used. No definite relation between the rate of dehydration and particle size of Al_2O_3 in Ni–Al_2O_3 mixtures could be established. The *X*-ray spacings of Ni show that its lattice is deformed; the activation energy of dehydrogenation is the higher the more compressed is the lattice. The rate of dehydrogenation of *cyclo*hexane and HCO_2H is a max. when the Ni crystals are ~80 A. but the activity of Ni for hydrogenation of C_6H_6 or CO is the higher the smaller is the particle size (40—120 A.). J. J. B.

Consecutive stages in heterogeneous catalysis. A. A. Balandin (*J. Phys. Chem. Russ.*, 1940, **14**, 1160—1175).—A review is given of the author's "multiplet" theory (A., 1936, 167). The three stages of the process, *i.e.*, the adsorption, the reaction, and the desorption, are considered in detail. New experiments are reported on hydrogenation of org. halides in presence of C; the rate of these reactions is determined by that of desorption, especially of the desorption of HCl or HBr. Under identical conditions at 400° 3% of PhBr, 28% of $CHCl_3$, 42% of $Bu^\alpha Br$, 51% of $Bu^\gamma Cl$, and 58% of allyl chloride exchanged their halogen for H. In H_2O on Pt, NHAcBr and H_2 yield AcOH, NH_2Ac, HBr, Br, and NH_4Br; the rate of this reaction shows a max. when about 0·75 of the H has been consumed. It was often supposed that $Al(OEt)_3$ is an intermediate product of dehydration of EtOH in presence of Al_2O_3. The decomp. of gaseous $Al(OEt)_3$ gives Et_2O whereas C_2H_4 is produced when EtOH is passed over hot Al_2O_3. The rate of the Et_2O formation is complicated and suggests the formation of another Al ethoxide containing more Al. J. J. B.

Mechanism of dehydration and dehydrogenation of alcohols of the homologous series C_nH_{2n+1}·OH on homogeneous catalysts. A. C. Bork (*J. Phys. Chem. Russ.*, 1940, **14**, 1288—1300).—Earlier results are reviewed. The energy of activation of alcohols calc. both from dehydration and from dehydrogenation is reduced by introduction of a Me group. Various alcohols are transformed on the same active spots of a catalyst. J. J. B.

Enhancing the activity of nickel formate catalysts. D. P. Dobitschin (*J. Phys. Chem. Russ.*, 1940, **14**, 1284—1287).—To prepare an active catalyst the original system should be as far from the equilibrium as possible. When Ni catalysts are prepared from Ni formate in H_2, the H_2 current should be rapid and the temp. high (245—250°). The range 200—240° should be crossed as quickly as possible; it is advisable to introduce a paste of $(HCO_2)_2Ni$ + oil into oil preheated to 245°. The H_2 must be dry to avoid the reaction $Ni + H_2O \rightleftharpoons NiO + H_2$ which yields an inactive Ni. When the H_2 is moist, an increase of its speed is of little advantage. J. J. B.

Electrochemical preparation of sodium chlorate from aqueous sodium chloride. S. S. Joshi and K. Srinivasan (*J. Indian Chem. Soc.*, 1941, **18**, 623—630).—Current efficiency of $NaClO_3$ formation increases with temp., with increase in initial [NaCl], increase in anodic and decrease in cathodic c.d., and rises to an optimum val. with an electrode separation of 5 cm. Of a no. of addition agents investigated, $K_2Cr_2O_7$ is the most efficient. No $NaClO_3$ is formed in cells exposed to sunlight or using a.c. F. R. G.

Electrolytic and polarographic reduction of molybdenum solutions. R. Höltje and R. Geyer (*Z. anorg. Chem.*, 1941, **246**, 258—274).—The electrolytic reduction of Na_2MoO_4 (0·025M.) in 1—20N-H_2SO_4 and 1—6N-HCl has been studied by potential measurements and oxidimetric titration of the reduced solutions. Reduction proceeds through Mo^V to Mo^{III}; at low [H^+] $Mo(OH)_3$ is pptd. The in-

fluence of the acid and Mo concns. on the Mo^{VI}–Mo^{V} and Mo^{V}–Mo^{III} redox potentials is examined. Polarographic data are given for solutions of Mo^{VI} in H_2SO_4, HCl, H_3PO_4, and $HClO_4$; four waves are observed, corresponding with the processes $Mo^{VI} \rightarrow Mo^{V}$, $Mo^{V} \rightarrow Mo^{III}$ (red), $Mo^{V} \rightarrow Mo^{III}$ (green), and $Mo^{VI} \rightarrow Mo(OH)_3$. Alkaline Mo^{VI} solutions are not reducible polarographically. (Cf. A., 1942, I, 275.) A. J. E. W.

Deposition of hard bright nickel.—See B., 1942, I, 313.

Nickel-plating magnesium alloys.—See B., 1942, I, 315.

High-efficiency cyanide copper [plating] bath.—See B., 1942, I, 312.

Deposition of copper–nickel, copper–cadmium, and copper–zinc alloys from thiosulphate solutions.—See B., 1942, I, 312.

Tin-plating from stannous ammonium oxalate.—See B., 1942, I, 313.

Lead plating.—See B., 1942, I, 314.

Electrolytic polishing of silver.—See B., 1942, I, 314.

Cathodic protection [of metals].—See B., 1942, I, 317.

Mixed electrolytes of nitrates with adipates, lævulates, and *β-iso*-amyloxypropionates.—See A., 1942, II, 216.

Electrolysis of deuterium-containing fatty acids. III. Mechanism of propylene and propane formation during electrolysis of butyric acids. W. Schanzer and K. Clusius (*Z. physikal. Chem.*, 1942, **A, 190**, 241—253).—The electrolysis of aq. solutions of butyric acids in which one or more H atoms have been replaced by D atoms has been investigated. α-H atoms exchange with those from H_2O. C. R. H.

Chemical reactions in electric discharges. XXVII. Production of hydrazine by means of high- and low-frequency arcs burning in nitrogen–hydrogen mixtures or in ammonia. E. Briner and H. Hoefer (*Helv. Chim. Acta*, 1942, **25**, 96—97).—Arc discharges in N_2–H_2 mixtures do not produce N_2H_4. Those in NH_3 afford N_2H_4 in small yield, which is increased by using high frequencies, low pressures, and rapid streaming. F. J. G.

Activation effects on solid substances, particularly by irradiation and variation of the magnetic state. J. A. Hedvall (*Angew. Chem.*, 1941, **54**, 505—507).—The activation of HgS, CdS, CdI_2, $CdBr_2$, $CdCl_2$, and CdF_2 is reviewed. J. L. E.

Technique for examining latent image distribution.—See B., 1942, II, 247.

Photochemical reaction between bromine and chloral. H. Klug and H. J. Schumacher (*Z. physikal. Chem.*, 1940, **B, 47**, 67—92).—Br and CCl_3·CHO when irradiated with λ 4360 A. at 70—90° undergo a chain reaction yielding CO, HBr, CCl_3Br, $COBr_2$, and $CHCl_3$. The quantum yield at 90°, with partial pressures of CCl_3·CHO and Br 100 mm., and $3{\cdot}5 \times 10^{13}$ quanta absorbed per c.c., is ~120 mol. per quantum. The temp. coeff. is 1·57 per 10°. The initial rate of formation of CO ∝ [CCl_3·CHO][Br]^0[light intensity]$^{\frac{1}{2}}$. The reaction is inhibited by traces of O_2 and by CCl_3·COBr. Addition of N_2 or CCl_3Br has no effect on the rate. The main reaction is CCl_3·CHO + 2Br = CCl_3Br + CO + HBr, followed by CCl_3Br + HBr = $CHCl_3$ + 2Br. L. J. J.

Photochemical activity of mixtures of vanadic acid and tartaric acid. III. Induced circular dichroism in vanadic acid sol. Photoreduction of dichroic sol by tartaric acid in circularly polarised light. T. L. R. Char (*J. Indian Chem. Soc.*, 1941, **18**, 605—608).—Photoreduction in *d*-light by K *d*-, *l*-, or *dl*-tartrates of vanadic acid sol pre-excited in *d*-light is > in *l*-light and vice versa. F. R. G.

Action of light on cellulose solutions. E. Stœurer (*Z. physikal. Chem.*, 1940, **B, 47**, 127—154).—The viscosity of methylcellulose (**I**)–dioxan solutions decreases irreversibly on irradiation with λλ >3130 A., at a rate independent of λ. Methylcellobiose is demethylated in similar conditions, giving CO and CH_4. End-group determinations by the method of Hess and Neumann show a decrease in the degree of polymerisation of (**I**) on irradiation, involving rupture of glucosidic linkages, without demethylation. L. J. J.

Effects of water on the photochemical bromination of acetophenone. E. M. Hicks, H. M. Hicks, and J. R. Sampey (*J. Amer. Chem. Soc.*, 1942, **64**, 887—889).—Photochemical bromination of COPhMe in CCl_4 is retarded by small amounts of H_2O which remove the catalytic HBr; when larger amounts of HBr have been formed, appreciable amounts remain in the CCl_4 and reaction becomes very rapid. Addition of a little conc. HCl (by increasing the [H$^+$] in the CCl_4) or P_2O_5 (by removing H_2O) accelerate the reaction. Increase of surface by addition of S is without effect. The prototropic nature of the reaction in CCl_4 is thus confirmed. R. S. C.

IX.—METHODS OF PREPARATION.

Calcium silicates. T. Thorvaldson (*Canad. Chem.*, 1942, **26**, 197—199).—A review. D. F. R.

Hydrolysis of tricalcium arsenate. H. Guérin (*Compt. rend.*, 1941, **213**, 129—130).—Investigation of the system As_2O_5–CaO–H_2O between 17° and 90° in glass vessels shows that hydrolysis takes place above 60°. When the investigation was carried out in Cu vessels, no hydrolysis occurred, even at 90°. It is concluded that the hydrolysis occurring in glass vessels is effected by alkali dissolved from the glass. A. J. M.

Double hydroxides and basic double salts. II. Mixed precipitates from calcium–aluminium salt solutions. W. Feitknecht [with M. Gerber] (*Helv. Chim. Acta*, 1942, **25**, 106—131).—Ppts. obtained by addition of NaOH to Ca + Al salt solutions or of Ca salts to Na aluminate solutions contain *basic double salts* of widely varying composition. They have layers of $Ca(OH)_2$ with every third Ca position vacant, separated by layers of basic Al salt. In presence of Ca$^{··}$, $Al(OH)_3$ redissolves at a lower p_H than usual. F. J. G.

Co-precipitation of radium and barium salts as a function of temperature and acidity. W. B. Pietenpol (*J. Chem. Physics*, 1942, **10**, 211—214).—More Ra than Ba is pptd. from a solution of $RaBr_2$ and $BaBr_2$ on cooling. By separating liquor from crystals at > room temp. the factor of enrichment is increased and the process of separation accelerated. Factors of enrichment have been determined for different acidities; increase in acidity decreases the crystallisation factor on cooling from boiling to room temp., but on cooling through a small temp. range the inverse occurs. The relative amounts of Ba and Ra depend on the rate of cooling, more Ra being deposited on slow cooling. W. R. A.

Double hydroxides and basic double salts. III. Magnesium aluminium double hydroxide. W. Feitknecht [with M. Gerber] (*Helv. Chim. Acta*, 1942, **25**, 131—137).—Ppts. obtained by addition of NaOH to $MgCl_2$ + $AlCl_3$ solutions or of $MgCl_2$ to Na aluminate solutions contain a *double hydroxide* of widely variable composition. It is hexagonal rhombohedral with *a* 3·09, *c* 23·7 A., and has layers of $Mg(OH)_2$ separated by layers of disordered $Al(OH)_3$, a part of the OH′ being replacable by Cl′. F. J. G.

Extraction of zinc from ammonia buffers by means of dithizone. A. Walkley (*J. Proc. Austral. Chem. Inst.*, 1942, **9**, 29—34).—Data for the partition of Zn between aq. NH_3 + NH_4 citrate and $CHCl_3$ solutions of dithizone show that Zn can be extracted readily from the aq. phase up to, at least, p_H 10·5, and that the partition of Zn is related more closely to [NH_4] than to p_H. Extraction of Zn is rapid at p_H <8. L. S. T.

Reactions in the solid state at high temperatures. XXVII. Intermediate states which appear in the formation of willemite from zinc oxide and silica in the solid state. W. Jander and H. Riehl (*Z. anorg. Chem.*, 1941, **246**, 81—99).—A study of the *X*-ray diagrams and the sorptive and catalytic activities of ZnO–SiO_2 mixtures after ignition at various temp. leads to the following conclusions. At >500° the SiO_2 surface is activated by adsorption of ZnO. This corresponds with an increase of sorptive and catalytic activity. At 500—800° with amorphous SiO_2, or at 500—700° with quartz, the sorptive and catalytic activities decrease corresponding with a firmer binding: the first Zn_2SiO_4 mols. are being formed on the SiO_2 surface. Combination begins to be detectable chemically at 700—800°, and the first *X*-ray lines of Zn_2SiO_4 are observed after ignition at 860—900°. These first crystallites have distorted lattices, and they are responsible for sharp max. of catalytic and sorptive power in mixtures ignited at ~930° for amorphous SiO_2 and at 800—900° for quartz. At higher temp. the imperfections of the lattice are rapidly healed. F. J. G.

Reactions of solid substances. CXX. Changes of the ease of dissolution of zinc oxide and chromic oxide in the course of their mutual combination. G. F. Hüttig and H. Theimer (*Z. anorg. Chem.*, 1941, **246**, 51—66).—Intermediate stages in the reaction ZnO + Cr_2O_3 = $ZnCr_2O_4$ have been investigated by means of changes in the ease of dissolution of the two oxides in acids. The *X*-ray lines of $ZnCr_2O_4$ first appear after ignition at 700°, but changes of colour and of ease of dissolution begin after ignition at 550°. With rise of temp. of ignition, the ease of dissolution of ZnO decreases whereas that of Cr_2O_3 increases at first to a sharp max. for mixtures ignited at 750°, corresponding exactly with an increase to a max. of the adsorptive power for methylene-blue. These results indicate that the ZnO is the "activator" and the Cr_2O_3 the "activated substance." The results are compared with those for analogous systems, and mechanisms suggested. F. J. G.

Preparing dry ammonia. W. Q. Bunderman (*J. Chem. Educ.*, 1941, **18**, 545).—Conc. aq. NH_3 is dropped on to dry sticks of NaOH or KOH. L. S. T.

Nitrogen bromide. M. Schmeisser (*Z. anorg. Chem.*, 1941, **246**, 284—302; cf. A., 1940, I, 265).—Full details of the prep., analysis, and properties of NBr_3,$6NH_3$ (**I**) are given, and the mechanism of its formation is discussed. The best yields were obtained by passing NH_3 (~2 vols.) and a mixture of N_2 and Br_2 vapour (3·6 : 1; 1 vol.) separately into a trap at 100°, which retained NH_4Br, and condensing

(I) in an adjacent trap at −95°. A glow discharge has no effect on the formation of (I), and does not cause N_2 and Br_2 vapour to react. A. J. E. W.

Question of the existence of the pyro- and meta-arsenic acids. N. Kolarow (*Z. anorg. Chem.*, 1941, **246**, 14—18).—Over a temp. range of 40—160°, and at pressures of H_2O vapour between 8·8 and 588·6 mm., $3As_2O_5,5H_2O$ is the only hydrate in equilibrium with aq. arsenic acid. An equilibrium diagram is given. F. J. G.

Question of the existence of free pyroarsenic acid. A. Simon and E. Thaler (*Z. anorg. Chem.*, 1941, **246**, 19—27).—The supposed $H_4As_2O_7$ obtained by Rosenheim (A., 1930, 558) consists of $3As_2O_5,5H_2O$ contaminated with mother-liquor. F. J. G.

Higher oxides of bismuth and the bismuthates. H. Martin-Frère (*Compt. rend.*, 1941, **213**, 436—437).—Addition of hot conc. aq. $Na_2S_2O_8$ to a boiling solution of $Bi(OH)_3$ in 60% aq. NaOH affords an orange-yellow ppt. of $NaBiO_3$ which can be dried in vac. over H_2SO_4 without decomp. Treatment of the dried ppt. with 5% HNO_3 at 0° for 12 hr. furnishes a residue of Bi_2O_4 but no Bi_2O_5. A. R. P.

Affinity. XCVI. Tantalum phosphides. M. Zumbusch and W. Biltz (*Z. anorg. Chem.*, 1941, **246**, 35—45).—The system Ta–P has been studied by means of tensimeter curves and *X*-rays. Ta forms two *phosphides*, TaP and TaP_2; their prep. requires the use of very finely-divided Ta and high temp. and pressure. TaP has p_4^{25} 10·85 and TaP_2 8·41. An unstable modification of TaP sometimes is formed by dissociation of TaP_2; it is metastable under all conditions. TaP and TaP_2 are fairly resistant to reagents, but are attacked by hot NaOH or hot HNO_3. F. J. G.

Thionylimide, SONH. P. W. Schenk (*Ber.*, 1942, **75**, [*B*], 94—99).—Interaction of $SOCl_2$ (1 mol.) and NH_3 (3 mols.) in the gaseous phase gives *thionylimide*, m.p. −85°, affording a colourless liquid which polymerises at −70° to a transparent, yellow-brown mass resembling bakelite. When polymerised it is insol. in the usual org. media except MeOH, EtOH, and $COMe_2$ with which it appears to react. H. W.

Existence of double shelled chromic acetate complexes. H. Spandau and D. Zillessen (*Z. anorg. Chem.*, 1941, **246**, 100—111).—The results of Brintzinger and Jahn (A., 1937, I, 81) cannot be confirmed by the method of Jander and Spandau (A., 1940, I, 204). F. J. G.

Existence of double shelled chromic acetate complexes. H. Brintzinger (*Z. anorg. Chem.*, 1941, **246**, 112—114).—A reply to Spandau and Zillessen (cf. preceding abstract). F. J. G.

Behaviour of molybdenum solutions towards reducing agents. R. Höltje and R. Geyer (*Z. anorg. Chem.*, 1941, **246**, 243—257).—The reduction of Mo^{VI} solutions has been studied by potential measurements and oxidimetric titration of the reduced solutions. In acid solutions Zn and Cd give successively Mo^{V} and Mo^{III}, with no evidence of Mo^{IV}. $Mo(OH)_3$ is formed from slightly acid solutions and Zn, and from neutral solutions with Zn and NH_4 salts. Hg and >4N-HCl, or Ag and >3N-HCl, give Mo^{V}, but at higher [HCl] Mo^{III} is also formed; these reactions can be used in volumetric determination of Mo. Cr^{II} in strongly acid solutions gives Mo^{III}. Ti^{III} and Sn^{II} give Mo^{V}, but reduction proceeds further with Sn^{II} and 8N-HCl. With Fe^{II} partial reduction to Mo^{V} occurs in strongly acid solutions. The action of N_2H_4, KI, KBr, SO_2, $H_2C_2O_4$, and H_2O_2 on molybdate solutions is briefly discussed. A. J. E. W.

Reactions in the solid state. XXVI. Active intermediate states which appear in the formation of tungstates, especially of copper tungstate, in the solid state. W. Jander and W. Wenzel (*Z. anorg. Chem.*, 1941, **246**, 67—80).—Combination of CuO and WO_3 begins suddenly at 500°. Preps. ignited at this temp. show a max. of ease of dissolution of WO_3, a min. of adsorptive power for dyes (which is followed by a sharp max. for preps. ignited at 440°), a sharp max. of catalytic activity for the combustion of CO (which corresponds with a marked increase of the apparent energy of activation), and the first detectable *X*-ray lines of $CuWO_4$. The first-formed crystals of $CuWO_4$ give no indications of lattice distortion. Preps. heated at >480° show no sign of combination, but a steady increase of ease of dissolution of WO_3, accompanied by a steady fall of catalytic activity, whilst at 480° the adsorptive power falls sharply, indicating in this range a gradual blocking of the CuO surface by surface combination with WO_3. The behaviour of preps. heated at 500—512° indicates that here the catalytically active material is a conglomerate of $CuWO_4$ with still unchanged CuO or WO_3. The dependence on ignition temp. of the catalytic activity of $CuWO_4$ prepared in the wet way is completely different, indicating that different active centres are present. Intermediate stages in the prep. of $ZnWO_4$ and $MgWO_4$ have little or no catalytic power. F. J. G.

Structure, properties, and mode of formation of inorganic compounds of high mol. wt. of the type of the heteropoly-acids. II. Metatungstic acid, 1-phospho-12-tungstic acid, and 1-phospho-9-tungstic acid (luteophosphotungstic acid). G. Jander and F. Exner. **III. Heteropoly-compounds of the type of arsenotrimolybdic acid (2-arseno-1-hexamolybdic acid) and phosphomolybdic acids.** G. Jander and E. Drews (*Z. physikal Chem.*, 1942, **A. 190**, 195—216, 217—229; cf. A., 1942, I, 22).—II. The stability of W and P–W complexes towards p_H changes and the nature of the hydrolysis products have been investigated. The differences in the properties of the colourless and coloured forms of 1-phospho-1-hexatungstic acid are discussed.

III. As–Mo and P–Mo complexes have been investigated and compared with the corresponding P–W complexes. C. R. H.

Hydroxo-aquo cobaltic bisdiguanide and its salts.—See A., 1942, II, 251.

Formation of nickel, cobalt, and zinc ferrites at low temperature. (Mlle.) J. Longuet (*Compt. rend.*, 1941, **213**, 483—484).—$Ni(FeO_2)_2$, $Co(FeO_2)_2$, and $Zn(FeO_2)_2$ are formed when the hydroxides are pptd. simultaneously and boiled with H_2O. The corresponding Mg, Ba, and Pb compounds are not formed under these conditions. F. J. G.

X.—ANALYSIS.

Rapid determination of concentration in liquid-in-liquid solutions. L. K. Mann and H. L. Jeter (*Stain Tech.*, 1942, **17**, 25—26).—The method depends on the agitation resulting from surface tension (γ) differences when solutions of different concns. are mixed on a slide. If a drop of liquid is placed on a thin layer of another miscible liquid, the liquids will mix with no surface disturbance if their γ are equal. If the drop has the lower γ immediate spreading occurs; if the drop has the higher γ it remains as a convex drop for some time before spreading. Using known standard mixtures, concns. of other mixtures can be quickly checked. E. E. H.

Uniform system of indirect analysis. P. Fuchs (*Angew. Chem.*, 1941, **54**, 512—516).—A survey and mathematical interpretation of indirect analytical methods, the methods being divided into six primary groups: simple and multiple gravimetric, volumetric, and combined analysis. J. L. E.

Factors to be considered in quantitative polarography. I. M. Kolthoff (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 195—200). L. S. T.

Chromatographic adsorption analysis. H. H. Strain (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 245—249).—A review. L. S. T.

Interference in drop reactions. P. W. West (*J. Chem. Educ.*, 1941, **18**, 528—532).—A discussion. L. S. T.

Elimination of the water wave in polarographic work at relatively high indifferent electrolyte concentrations. I. M. Kolthoff and E. F. Orlemann (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 321—323).—The H_2O wave and the large errors that it may cause in the polarographic analysis of solutions with a concn. of indifferent electrolyte >0·5M. are eliminated by addition of 0·01% of gelatin. L. S. T.

Detecting basicity in slightly-soluble materials. F. Feigl and C. P. J. da Silva (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 316—319).—The solid to be tested is brought in contact with a solution that can form a coloured slightly-sol. inner complex salt, the pptn. of which is just prevented by an adequate [H·]. In such "equilibrium solutions," the introduction of OH· or solid basic materials that react even partly with dil. acids is followed immediately by formation of a coloured ppt. Suitable equilibrium solutions are formed by adding dimethylglyoxime or thionalide to Ni··, or α-benzoinoxime to Cu··. Minerals, glasses, inorg. and org. substances that react are listed. L. S. T.

Sodium salt of quinizarin-6-sulphonic acid as an acid–base indicator. J. H. Green (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 249).—Comparative data recorded show that this salt can be used as an indicator in the titration of strong acids with strong bases, and weak acids with strong bases. The colour changes are yellow to pink at p_H 7·1—9·1, and pink to blue-violet at 9·1—11·5 at 20°. The indicator can be used for the colorimetric determination of p_H over the range 7—11·5. The prep. of the indicator is described. L. S. T.

Gas-volumetric method of determining chlorine and carbon dioxide by the use of zinc amalgam. H. Hohn (*Angew. Chem.*, 1941, **54**, 307—308).—Cl_2 is absorbed from a mixture with CO_2 by means of damp Zn–Hg. The method gives the $[CO_2]$ to 0·1%. A. J. M.

Determination of fluorine as bismuth fluoride. L. Domange (*Compt. rend.*, 1941, **213**, 31—32).—BiF_3 is less sol. than CaF_2, although it is more sol. in acids. It is not hydrolysed. Its relatively high mol. wt. and its ease of separation and washing are advantages over CaF_2. The reagent is a solution of $Bi(NO_3)_3$ in AcOH. Details of procedure are given. A. J. M.

Simple micro-determination of sulphur, chlorine, bromine, and iodine in organic and inorganic material. K. Burger (*Angew. Chem.*, 1941, **54**, 479—481).—The substance is heated with K and the K_2S determined by titration with KIO_3, or the K halide by the usual methods. An accuracy of 0·3% is claimed. D. F. R.

Determination of dissolved oxygen [in water] by the dropping mercury electrode.—See B., 1942, III, 174, 175.

Turbidimetric determination of sulphates.—See A., 1942, III, 564.

Persulphate test with luminol and luminescence inductions with sulphurous acid. A. Steigmann (*J.S.C.I.*, 1942, **61**, 68).—Hæmin is preferable to $Cu^{··}$ as a catalyst in the luminol (**I**) test for H_2O_2 (cf. A., 1942, I, 153). Luminescence of (**I**) with S_2O_8'' without a catalyst requires the presence of H_2O_2 or perborate, whereas $Fe(CN)_6'''$, OCl', and MnO_4' cause luminescence in their absence. The test will detect 10 μg. of $(NH_4)_2S_2O_8$, the dilution limit being 1 : 10^5. Fumes from 3—4% aq. SO_2 induce luminescence of alkaline (**I**) with H_2O_2; aq. SO_2 also activates alkaline (**I**) and S_2O_8''. Treatment with aq. SO_2 improves subsequent bleaching of cloth by H_2O_2 at p_H 7·5—9·0. A. J. E. W.

Standardisation of sodium thiosulphate with potassium dichromate. B. D. Sully (*J.C.S.*, 1942, 366—368).—The reaction between $K_2Cr_2O_7$ and acidified (AcOH) KI is accelerated by a trace of $Cu^{··}$. The following procedure is recommended for the standardisation of $Na_2S_2O_3$: to 20 ml. of 0·1N-$K_2Cr_2O_7$ are added 5 ml. of glacial AcOH, 5 ml. of 0·001N-$CuSO_4$, and 20 ml. of H_2O, followed by 20 ml. of 15% KI. The liberated I is titrated with $Na_2S_2O_3$. Temp. should be <25°. 0·05 ml. must be subtracted from the titre to allow for I liberated by $Cu^{··}$. A slightly modified method of standardising $Na_2S_2O_3$ against Cu wire is also described. A. J. M.

[Determination of] sulphur in [alloy] steel.—See B., 1942, I, 310.

Volumetric determination of sulphur in coal and coke.—See B., 1942, I, 289.

Determination of free sulphur in lubricating oil.—See B., 1942, I, 293.

Rapid determination of combined nitrogen in steel.—See B., 1942, I, 310.

Determination of phosphorus by Lorenz's method. Y. E. Stourdzé (*Publ. Inst. Nac. Tecn., Rio de Janeiro*, 1941, 40 pp.).—The method of Lorenz (A., 1901, ii, 278) is preferred to that of Treadwell. F. R. G.

Determination of phosphorus in lubricating oil.—See B., 1942, I, 293.

Colorimetric determination of phosphorus in soils.—See B., 1942, III, 162.

Colorimetric determination of phosphate [in boiler water].—See B., 1942, I, 282.

Increase in the acidity of boric acid by the addition of neutral salts. Volumetric determination of boric acid. H. Schäfer and A. Sieverts (*Z. anorg. Chem.*, 1941, **246**, 149—157).—A large increase in the apparent dissociation const. of H_3BO_3 is produced by the addition of neutral salts, the effect being the greater the greater is the tendency of their cations to hydrate. If a solution of H_3BO_3 is made 3·5M. in $CaCl_2$ it can be titrated with alkali using a mixture of α-naphtholphthalein and *o*-cresol-red as indicator. At the end-point the colour change is from red-violet to blue-violet. If the solution is then diluted until the $[CaCl_2]$ is ~1·15M. the alkali used can be titrated with HCl using Me_2-yellow as indicator. If the H_3BO_3 solution is saturated with $CaCl_2,6H_2O$ titration can be carried out with Me-red as indicator. J. W. S.

Microchemical determination of silicic acid in silicates. I. P. Alimarin (*J. Appl. Chem. Russ.*, 1941, **14**, 431).—Smirnov and Isakov's method (A., 1941, I, 127) is criticised. King's method (A., 1933, 801) is preferred. N. G.

Determination of silicon, especially in steel and iron.—See B., 1942, I, 310.

Separation of silicon and tin in tin–silica mixture, welding brasses, and silicon brasses by alkali sulphate.—See B., 1942, I, 313.

Direct determination of potassium in silicate rock. H. H. Willard, L. M. Liggett, and H. Diehl (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 234—235).—The bases in insol. silicates are converted completely into perchlorates by evaporation of the silicate with HF and $HClO_4$, followed by steam-distillation at 140—150° to remove F as H_2SiF_6. After dehydration of the small residual amount of SiO_2 by means of $HClO_4$, the K is separated by extracting the sol. perchlorates with EtOAc. Removal of F by pptn. as CaF_2 (A., 1935, 1338) is untrustworthy. L. S. T.

Volumetric micro-determination of salt in butter.—See B., 1942, III, 169.

Separation of lithium from potassium and sodium by treatment of the chlorides with higher aliphatic alcohols. E. R. Caley and H. D. Axilrod (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 242—244).—$CHEtBu{\cdot}CH_2{\cdot}OH$ (**I**) is a better solvent than *iso*-$C_5H_{11}{\cdot}OH$ (**II**) for extracting LiCl from NaCl and KCl. No solubility corrections are necessary, and (**I**) need not be boiled in order to dehydrate the salts. The NH_4 stearate reaction for Li can be carried out in (**I**). The solubilities of LiCl, NaCl, and KCl in (**II**) and *n*-$C_6H_{13}{\cdot}OH$ are recorded. L. S. T.

Internal indicator method for determination of zinc in rubber compounds.—See B., 1942, II, 269.

Analytical possibilities of some hydroxybenzylidenerhodanines. A. W. Scott and T. E. Robbins (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 206—207).—The behaviour of $Cd^{··}$, $Ag^{·}$, $Co^{··}$, $Cu^{··}$, $Au^{···}$, $Fe^{···}$, $Pb^{··}$, and $Hg^{·}$ with solutions of rhodanine, *o*-, *m*-, or *p*-hydroxy- and 3 : 4-dihydroxy-benzylidenerhodanine (**I**) is tabulated. (**I**) is the only reagent that produces a distinctive deep red colour in alkaline (NaOH) solution with $Co^{··}$, $Mg^{··}$, and $Mn^{··}$. The lavender-coloured lake obtained with $Ni^{··}$ is characteristic. The slight solubility of the reagents in H_2O restricts their use as analytical reagents. L. S. T.

Extraction of metals from aqueous solutions with dithizone. Lead. L. P. Biefeld and T. M. Patrick (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 275—278).—The effects of p_H, CN′, OAc′, citrate (**II**), and tartrate, and amount of dithizone (**I**) used in Pb determinations are recorded. Favourable p_H ranges for extraction vary considerably with different masking anions, but only limited change occurs with variation in amount of excess of (**I**). (**II**) in extraction solutions is undesirable. L. S. T.

Determination of lead in sugars and sugar products.—See B., 1942, III, 166.

Amperometric titration of copper with [α-]benzoinoxime. A. Langer (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 283—285).—The half-wave potentials and wave heights depend on the p_H of the supporting solution, and the shapes of the titration curves depend on $[NH_3]$. For 10^{-3}M-Cu solutions, results are accurate to ~±1%. L. S. T.

Qualitative separation of copper and cadmium. D. Brawley (*J. Chem. Educ.*, 1941, **18**, 434).—$Cu^{··}$ is pptd. as CuCNS, and the $Cd^{··}$ as CdS from ammoniacal solution. L. S. T.

Separation of copper from cadmium with salicylaldoxime in qualitative analysis. L. P. Biefeld (*J. Chem. Educ.*, 1941, **18**, 526). L. S. T.

Separation of copper, lead, and zinc with salicylaldoxime. L. P. Biefeld and W. B. Ligett (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 359—361).—Pptn. of $Zn^{··}$ by means of salicylaldoxime (**I**) is complete only in the range p_H 7·1—8·1. $Cu^{··}$, $Pb^{··}$, and $Zn^{··}$ are separated by pptg. $Cu^{··}$ with (**I**) in slightly acid (modified Me-orange) solution, and $Pb^{··}$ in strongly ammoniacal solution in presence of much NH_4NO_3, which improves the separation from $Zn^{··}$ and permits wider latitude in the $[NH_3]$. $Zn^{··}$ cannot be pptd. quantitatively as the (**I**) compound in the filtrate from the pptn. of $Pb^{··}$. It is determined as $ZnNH_4PO_4$. L. S. T.

Photometric determination of copper in steel.—See B., 1942, I, 310.

Colorimetric determination of copper in light metal alloys.—See B., 1942, I, 315.

Microdetermination of mercury. I. Reifer (*New Zealand J. Sci. Tech.*, 1941, **23**, B, 13—15).—The solution is treated with a known excess of 0·005M- or 0·0005M-KI and titrated against 0·005M- or 0·0005M-$Ce(SO_4)_2$ using diphenylbenzidine in H_2SO_4–AcOH as indicator, CCl_4 being added to take up the I formed. I fixed as HgI_2 is found by difference. The method is accurate to ±1% with 0·05 mg. of Hg. M. H. M. A.

Phloroglucinol as reagent for the mercuric ion. G. V. Veselskaja (*J. Appl. Chem., Russ.*, 1941, **14**, 423—425; cf. A., 1938, III, 406).—Only *m*-polyphenols give ppts. with $Hg(NO_3)_2$ solutions (**I**). Phloroglucinol (**II**) is the most sensitive, giving a turbidity with 1 ml. of 0·001N-(**I**) acidified with HNO_3. Resorcinol and orcinol give a similar effect only with 1 ml. of 0·01N. solution. This reaction is sp. for $Hg^{··}$ in presence of other metallic ions and of $Hg^{·}$. The Hg–(**II**) complex, $C_6H_3(OH)_3,3HgO$, is not pptd. in presence of Cl′, Br′, I′, CN′, or CNS′, which must therefore be removed as Ag salts. Insol. Hg salts and org. Hg compounds except Hg rhodanine can be dissolved by heating with HNO_3–H_2SO_4 and then diluting. Decomp. to HgO by addition of alkali, and subsequent dissolution of the HgO in conc. HNO_3, can also be used. N. G.

Assay of yellow mercuric oxide ointment, U.S.P. XI.—See B., 1942, III, 170.

Spectrophotomeric determination of dysprosium, holmium, erbium, thulium, and ytterbium. C. J. Rodden (*J. Res. Nat. Bur. Stand.*, 1942, **28**, 265—277; cf. A., 1941, I, 430).—Using a double monochromator photo-electric spectrophotometer, the transimittancies of aq. $Dy(NO_3)_3$, $Ho(NO_3)_3$, $Er(NO_3)_3$, $Tm(NO_3)_3$, and $Yb(NO_3)_3$ have been measured over the λ range 3500—10,000 A. The bands most suitable for the determination of these elements are Dy 9100, Ho 6430, Er 5210 and 6530, Tm 6840, and Yb 9500 and 9730 A. Tb and Y show no appreciable absorption in the range investigated. J. W. S.

Electrolytic determination of iron. Modified Moore method. W. H. Armistead, jun. (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 207—209).—Fe is deposited at high c.d., without stirring, from hot solutions containing $Fe^{···}$, PO_4''', and excess of $(NH_4)_2CO_3$. W, NO_3, and strong oxidising agents must be absent. Large amounts of Cl′, SO_4'', and PO_4''', and >1% Mn do not interfere. Small amounts of Ni, Co, or Mo are quantitatively co-deposited with large amounts of Fe. L. S. T.

Steel analyses by drop reactions.—See B., 1942, I, 310.

Photometric determination of cobalt in steel.—See B., 1942, I, 310.

Colorimetric determination of nickel with ammonia. Spectrophotometric study. J. P. Mehlig (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 289—292).—The method although not highly sensitive (max. sensitivity 500—1500 p.p.m. Ni) is satisfactory. Precision is not high, but the average of several determinations gives a result in agreement with the gravimetric dimethylglyoxime method. The $[NH_3]$ must be controlled carefully. The colour system follows Beer's law, and is stable for ~4 weeks. The effect of 60 common ions is detailed. L. S. T.

Photometric determination of chromium in iron.—See B., 1942, I, 307.

Photometric determination of molybdenum in steel and cast iron.—See B., 1942, I, 310.

Determination of tin in presence of antimony and lead. M. F. Taboury and E. Gray (*Compt. rend.*, 1941, **213**, 481—483).—The Sn is converted into $SnCl_2$, the solution treated with H_2SeO_3, and the ppt. of Se weighed. F. J. G.

Microchemical reaction for quadrivalent tin. V. A. Nazarenko (*J. Appl. Chem. Russ.*, 1941, **14**, 419—420; cf. A., 1938, I, 268).—0·001 μg. Sn^{IV} in 0·001 ml. of solution can be detected by "bridging" with 0·0005 ml. of 0·1M-$[Fe(dipyridyl)_3]SO_4$ (**I**) solution in presence of excess of NaCl and HCl. Dark red, stellar crystals and aggregates (15—20 μ.), easily distinguishable from the rose-coloured, tabular or acicular crystals of $[Fe(dipyridyl)_3]Cl_2$ (700—800 μ.), are formed. Zn and Cd also react with (**I**), but the sensitivity of the reaction is less, and the crystals are of different sizes and shapes. As^V and Sb^V do not react with (**I**). N. G.

Spark spectrographic analysis of commercial tin.—See B., 1942, I, 313.

Vanadous sulphate as a reducing agent. IV. Determination of titanium. V. Action of vanadous sulphate on organic compounds. P. C. Banerjee (*J. Indian Chem. Soc.*, 1942, **19**, 30—34, 35—40).—IV. Ti may be determined (±2—3%) by titrating potentiometrically with VSO_4 in aq. H_2SO_4 at 70—80°. In presence of Fe there are three breaks in the titration curve corresponding with $Fe''' \rightarrow Fe''$, $V'''' + V'' = 2V'''$, and $Ti'''' \rightarrow Ti'''$.

V. Nitro-compounds [*e.g.*, $PhNO_2$, $C_6H_4(NO_2)_2$, *p*-$NO_2 \cdot C_6H_4 \cdot NH_2$, picric acid], methylene-blue, and indigo, have been determined by refluxing with excess of VSO_4 in CO_2 and then titrating the V'' with Fe alum. D. F. R.

Polarographic studies. I. Determination of antimony and bismuth. J. E. Page and F. A. Robinson (*J.S.C.I.*, 1942, **61**, 93—96).—Sb and Bi can be determined polarographically in blood and urine and in preps. of Sb and Bi used in chemotherapy. The determinations are normally performed in N-HCl containing 0·1% of gelatin, but if Sb and Bi are present together, the HCl must be replaced by N-H_2SO_4. The method is sp. for Sb^{III}; Sb^V must first be reduced by boiling with aq. Na_2SO_3. The half-wave potentials (versus the saturated Hg_2Cl_2 electrode) at 25° of Sb and Bi in N-HCl, -H_2SO_4, and -HNO_3, respectively, each containing 0·1% of gelatin, are: Sb_2O_3 −0·15, −0·34, −0·17 v.; Bi_2O_3 −0·11, −0·02, −0·03 v. An improved polarographic cell is described.

Colour reactions of niobium and tantalum. A. A. Dobina and M. S. Platonov (*J. Appl. Chem. Russ.*, 1941, **14**, 421—422; cf. A., 1937, I, 265; Schapiro, A., 1939, I, 102).—For Nb the yellow coloration obtained in presence of either (*a*) pyrocatechol and NaOAc or (*b*) KCNS or NH_4CNS and $SnCl_2$ is less sensitive (1 : 2500 and 1 : 25,000, respectively) than claimed by Schapiro. Ti, Mo, W, V, or Fe interferes. The reactions suggested by Schapiro (*loc. cit.*; A., 1938, I, 584), for the higher oxides of Nb and Ta would be vitiated in presence of Mo, W, V, Ti, Zr, Hf, and Th. Of the suggested reactions for Ta, only that with brilliant-green (9·5 μg. Ta per ml.) was confirmed. N. G.

Separation and micro-determination of palladium. W. B. Pollard (*Analyst*, 1942, **67**, 184—186).—Pd is separated from the other Pt metals, but not from Au, by boiling the feebly acid chloride solution with a solution of 1 : 2-NO·$C_{10}H_6$·OH in the min. amount of dil. aq. NaOH. The washed ppt. is redissolved in HNO_3 and the solution evaporated with HCl to expel N oxides; the residue is dissolved in 10 ml. of 1 : 1 HCl and the solution treated with 1 ml. of 40% aq. $SnCl_2$ and 5 ml. of C_6H_6. The Pd is then determined by titration with a 0·5% solution of $NEt_2 \cdot CS_2Na$ until the aq. layer is nearly colourless, 5 drops of 0·01% aq. $HgCl_2$ are added, and the titration continued with shaking until the red-brown colour in the C_6H_6 just disappears. The carbamate solution is standardised against a pure Pd solution. The brown colour produced by $SnCl_2$ in $PdCl_2$ solutions containing a trace of $HgCl_2$ is sp. and will detect 0·001 mg. of Pd in 2 ml. of 1 : 1 HCl. A. R. P.

XI.—APPARATUS ETC.

Application of infra-red radiation to spot-testing. W. W. Razim (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 278).—An infra-red lamp is used to heat solutions on a spot plate. L. S. T.

Intercomparison of platinum resistance thermometers between −190° and 445°.—See B., 1942, I, 281.

Stellar radiometric equipment at Harvard College Observatory. T. E. Sterne and R. M. Emberson (*Astrophys. J.*, 1941, **94**, 412—426). E. R. R.

Colloidal suspensions of herapathite for the preparation of polarising light filters. D. A. Godina and G. P. Faerman (*J. Appl. Chem. Russ.*, 1941, **14**, 362—367).—Colloidal suspensions of herapathite capable of being oriented are prepared from quinine bisulphate and I in a viscous solution of cellulose nitrate in C_6H_6–MeOH in presence of HI. The prep. of the polarising films is described. N. G.

Accuracy of the determination of concentration with photo-electric spectrophotometers. G. Kortum (*Angew. Chem.*, 1941, **54**, 442—447). D. F. R.

Recording spectrophotometer and spectropolarimeter. W. R. Brode and C. H. Jones (*J. Opt. Soc.*, 1942, **31**, 743—749).—An instrument combining a fully-automatic recording spectrophotometer and spectropolarimeter is described. J. W. S.

Rapid photographic spectrophotometry. G. E. Davis and J. W. Woodrow (*Rev. Sci. Instr.*, 1942, **13**, 223—228).—A new quartz spectrograph employs a modification of the usual photographic method, and has the advantages of high speed and the possibility of determining a large no. of vals. with only two exposures. It is applicable to solids as well as liquids and solutions. A. J. M.

Photometer for determining nitrogen dioxide concentrations [to within 0·05 mm.]. L. Harris and B. M. Siegel (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 258—260). L. S. T.

Production of equal energy spectrum. E. Lau and H. Theissing *Physikal. Z.*, 1941, **42**, 61—63).—An arrangement of slits and filters in conjunction with a prism spectrograph is described. A. J. M.

Materials and devices of falling resistance–temperature characteristic. R. W. Sillars (*J. Sci. Instr.*, 1942, **19**, 81—84).—The use of electronic semi-conductors (*e.g.*, U_3O_8) as resistors of which the resistance decreases with rising temp. is described. The applications of such resistors to thermometry and temp. control, compensation of increase of resistance of a coil due to local changes of temp., and various other processes are described. A. J. M.

Construction and operation of a polarograph. N. H. Furman, C. E. Bricker, and E. B. Whitesell (*Ind. Eng. Chem.* [*Anal.*], 1942, **14**, 333—340).—Details of construction of the instrument and of a modified electrode assembly are given. L. S. T.

Coincidence ionisation amplifier. C. Magnan (*Compt. rend.*, 1941, **213**, 476—479).—An apparatus is described for the investigation of the energy of the groups of particles formed in the disintegrations of U salts under slow neutron bombardment. It consists of two co-axial ionisation chambers with three-stage amplifiers and an electronic reversing device which blocks the indication of one amplifier while the other registers, the process alternating at the rate of 10^4 times per sec. This device controls a cathode tube, and hence energies of two particles formed simultaneously can be measured. N. M. B.

Canal-ray positive-ion sources. J. D. Craggs (*Proc. Physical Soc.*, 1942, **54**, 245—265).—The positive-ion output available from cold-cathode glow discharge tubes with a canal drilled through the cathode is discussed with reference to practical precautions and technique. Measurements of intense positive-ion currents, focussing, and electrostatic and magnetic deflexion and analysis of the beam are reported. N. M. B.

Colloidal graphite electrostatic shielding. B. H. Porter (*Rev. Sci. Instr.*, 1942, **13**, 129—130).—Aquadag with H_2O (1 : 2) is used to coat clean glass surfaces instead of employing metal shields. Baking and polishing are advantageous. Coated cardboard tube can also be used. Coated rubber tubing, which remains flexible, can be used instead of metal conduits where conductivity is required. A. A. E.

Behaviour of proportional counter amplification at low voltages. M. E. Rose and W. E. Ramsey (*Physical Rev.*, 1942, [ii], **61**, 198—199).—Studies previously reported (cf. A., 1941, I, 349) were extended to the region of low gas amplification by a method based on the comparison of currents in a counter measured at potentials above and below the threshold voltage (at which the gas amplification factor begins to depart from 1); the amplification at any voltage is then directly obtained as the ratio of these currents. The apparatus and preliminary results are briefly described. N. M. B.

Photo-electric instrument measuring quality and quantity of *X*-rays for radiographic purposes. R. H. Herz (*Brit. J. Radiol.*, 1942, **15**, 110—113).—A barrier-layer photocell is employed with a fluorescent screen. L. J. J.

Grid-controlled *X*-ray diffraction tube. A. Eisenstein (*Rev. Sci. Instr.*, 1942, **13**, 208—212).—A square wave generator is described, and its voltage is impressed on a grid in an *X*-ray tube. The grid potential varies in such a way that the electron current flows only when the voltage is sufficiently high to excite the *K* series. This modulated grid gives considerable increase in efficiency in excitation of *Kα* radiation. A. J. M.

Detection of radon by means of a proportional counter. S. C. Brown, L. G. Elliott, and R. D. Evans (*Rev. Sci. Instr.*, 1942, **13**, 147—151).—(1) Rn (~10^{-12} curie) is conc. in a liquid-air trap before being put into the small counter. (2) Rn is swept into the counter with He. Method (2) is the more efficient. A. A. E.

Temperature coefficients in self-quenching counters. S. A. Korff, W. D. B. Spatz, and N. Hilberry (*Rev. Sci. Instr.*, 1942, **13**, 127).—A counter filled to about 7 cm. Hg with CH_4 gave the normal quenching action on a resistance of 1 megohm, and showed no change of counting rate with temp. over the range −22° to 55°. A. A. E.

Properties and applications of the Geiger–Müller photo-electron counter. O. S. Duffendack and W. E. Morris (*J. Opt. Soc. Amer.*, 1942, **32**, 8—24).—A Geiger–Müller photo-electron counter made of quartz with a Ni cathode is described. Its performance, tested by the determination of the relative intensities of spectral lines with the counter and comparison with results obtained by photographic spectrophotometry, is satisfactory when the lines compared are close together. The counter responds linearly to linear variation of intensity of a Hg-vapour lamp. A. J. M.

Increase in resolving power of the emission electron microscope. H. Boersch (*Naturwiss.*, 1942, **30**, 120).—Modifications which increase the resolving power to 0·07 *μ*. are described. A. J. M.

Universal electron microscope. M. von Ardenne (*Physikal. Z.*, 1942, **43**, 11—15).—Various improvements in the design of the universal electron microscope are described. A new 0·9-mm. magnetic objective is described. The apparatus includes an objective heater which enables observations to be made up to 2000°. Photographs showing the change of ZnO into basic Zn carbonate in an atm. of CO_2, and some electron diffraction diagrams are given. A. J. M.

Resolving power of electron microscopes. M. von Ardenne (*Physikal. Z.*, 1941, **42**, 72—74).—The determination of the resolving power of electron microscopes is described. The construction of test preps. for the purpose is considered. The resolving power of modern electron microscopes is 2·2 m*μ*. A. J. M.

Emission-regulating circuit for an ionisation gauge. R. B. Nelson and A. K. Wing, jun. (*Rev. Sci. Instr.*, 1942, **13**, 215—217).—The circuit employs gas-filled tetrodes, and maintains const. electron emission in an ionisation gauge by control of filament temp. A. J. M.

Fluorescent lamp as voltage stabiliser. L. G. Parratt and R. G. Stephenson (*Rev. Sci. Instr.*, 1942, **13**, 233—234). A. J. M.

Modified micro-pipette for density determinations in heavy water analysis. F. Rosebury and W. E. van Heyningen (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 363—364). L. S. T.

Apparatus for precision calibration of pipettes, volumetric flasks, and burettes. W. R. Thompson (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 268—271). L. S. T.

Simple micro-burette. P. F. Holt and H. J. Callow (*J.S.C.I.*, 1942, **61**, 99—100).—An easily-made micro-burette of capacity 0·6 c.c. is of the "closed-system" type and uses air instead of Hg to expel the liquid. Certain errors in micro-titration are discussed with particular reference to the determination of Ca in solutions of its salts.

Medium for m.p. baths. J. Kamlet (*Science*, 1942, **95**, 308).—Dowtherm A (Ph_2O 73·5, Ph_2 26·5%) is liquid between 12° and 258°; neither liquid nor vapour is toxic, corrosive, or spontaneously inflammable. $\mu^{20} = 1{\cdot}5884$; sp. heat = 0·63 at 100°; d^{100} 0·995. E. R. R.

Film-contraction errors in lattice-spacing measurements. H. Lipson (*J. Sci. Instr.*, 1942, **19**, 63; cf. A., 1942, I, 27, 116).—By using steel tapes to support the film the scale remained linear within experimental error although the film had shrunk by 0·3% during a period of 4 months. D. F. R.

Accurate automatic syringe mechanism. A. L. Sims and R. C. Jordan (*J. Sci. Instr.*, 1942, **19**, 58—61).—The glass syringe and valve system is automatically operated by a series of levers attached to a 10-w. synchronous motor through a reduction and a variable gear giving a wide range of interval between successive operations. The vol. and time interval may be adjusted over a wide range. D. F. R.

Apparatus for micro-evaporations. L. T. Kurtz (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 191).—Hot air is allowed to play on the surface of the solution, which is heated by a steam jacket. 0·3 ml. is evaporated in 2—3 min. L. S. T.

Semi-micro-pyknometer for heavy water. B. J. Fontana and M. Calvin (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 185—186).—The pyknometer is filled by means of a high-vac. line, and gives, with ~1 c.c. of liquid, results reproducible to 1—2 in 10^4 without thermostatic control. L. S. T.

Apparatus for distillation of corrosive liquids as used for purification of chlorosulphonic acid. A. W. Hixson and A. H. Tenney (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 345). L. S. T.

Dialysing concentrator. C. C. Smith and C. D. Stevens (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 348—349).—Apparatus for simultaneous dialysis and concn. is described. L. S. T.

Turbidity comparator. R. P. Krebs, P. Perkins, A. A. Tytell, and H. Kersten (*Rev. Sci. Instr.*, 1942, **13**, 229—232).—An a.c. operated photo-electric turbidity comparator is described. A. J. M.

Fuzz detector for viewing glass weighing vessels in organic quantitative micro-analysis. D. F. Hayman and W. Reiss (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 357).—An optical arrangement for detecting foreign material on glass surfaces is described. L. S. T.

Apparatus for the extraction of easily-emulsified liquids with immiscible solvents. P. F. Holt and H. J. Callow (*J.S.C.I.*, 1942, **61**, 84).—A simple method is described for the extraction of aq. solutions by org. solvents with which they easily emulsify. The method is convenient for use with relatively small quantities.

Extractor for use with larger quantities of plant material. R. C. Burrell and A. C. Wolfe (*J. Chem. Educ.*, 1941, **18**, 513). L. S. T.

Optical hygrometer and its working. L. D. Mahajan (*Indian J. Physics*, 1941, **15**, 425—432). W. R. A.

Molecular models with free rotation. C. E. Black, 3rd, and M. Dole (*J. Chem. Educ.*, 1941, **18**, 424—427). L. S. T.

Thermoelectric method of measuring vapour pressure. R. R. Roepke (*J. Physical Chem.*, 1942, **46**, 359—366).—The advantages of Baldes' method are discussed (cf. A., 1934, 986 and subsequently). C. R. H.

Support for reflux condensers. E. J. Benne (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 264).—A support for a battery of six condensers is described. The condensers and flasks are not clamped, and, if desired, can be easily rotated. L. S. T.

[Crater] cutter for spectroscopic electrodes. E. S. Hodge (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 260). L. S. T.

Column packing and separation of isotopes. H. G. Thode and F. O. Walkling (*Canad. J. Res.*, 1942, **20**, **B**, 61—68).—The expanded shale aggregate packing described gives good results in hydrocarbon and H_2O distillations. L. J. J.

Clusius–Dickel separation tube and the physical-mathematical theory of its mode of operation and capacity. H. Jensen (*Angew. Chem.*, 1941, **54**, 405—412).—A mathematical interpretation of the thermal diffusion method for the separation of isotopes. J. L. E.

Membrane interferometer manometer. J. M. Tobias (*Rev. Sci. Instr.*, 1942, **13**, 232—233).—A thin collodion film is used as one of a pair of interferometer reflectors. Observations of fringes make it possible to determine very small changes of pressure. A change of ~0·05 mm. of H_2O can be detected. A. J. M.

Vibrograph used as a viscometer. T. Tirunarayanachar (*Indian J. Physics*, 1941, **15**, 417—423).—*η* of highly viscous liquids can be compared by a method involving an improved form of vibrograph which photographically records the damped oscillations. For glycerol at various temp. $\eta\rho \propto$ a function of damping coeffs. of the instrument. W. R. A.

Rotary viscosimeter for determination of high consistencies. R. N. Traxler, J. W. Romberg, and H. E. Schweyer (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 340—344).—Details of design and operation, and results for asphalts over the range 0·001 to 10^3 megapoises, are given. L. S. T.

[Sintered-glass] filtering device for viscosity tubes. S. J. Hetzel (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 288). L. S. T.

Viscosimetric characterisation of particle size of high polymerides. A. Matthes (*Angew. Chem.*, 1941, **54**, 517—520).—A mathematical criticism of Staudinger's method for viscosity determinations and the concn. limits within which the formulæ used give accurate results. J. L. E.

XII.—LECTURE EXPERIMENTS AND HISTORICAL.

Demonstration of adsorption [of coloured ions]. G. W. Smith (*J. Chem. Educ.*, 1941, **18**, 432). L. S. T.

Experiment in electrical calorimetry. [Reduction of dilute ferric chloride by dilute stannous chloride in 2N-hydrochloric acid.] I. Cameron and R. H. Wright (*J. Chem. Educ.*, 1941, **18**, 510—513). L. S. T.

Organic demonstration. [Reaction between β-amino*iso*butyl alcohol and α-ethylhexaldehyde.] M. Senkus (*J. Chem. Educ.*, 1941, **18**, 595). L. S. T.

Early chemistry at Le Jardin du Roi. C. de Milt (*J. Chem. Educ.*, 1941, **18**, 503—509). L. S. T.

Lewis Reeve Gibbes and the classification of the elements. W. H. Taylor (*J. Chem. Educ.*, 1941, **18**, 403—407). L. S. T.

XIII.—GEOCHEMISTRY.

Waters of the Scotian shelf. H. B. Hachey (*J. Fish. Res. Bd. Canada*, 1942, **5**, 377—397).—Temp. and salinities of the "upper," "intermediate," and "bottom" layers are given. The submarine physiography of the shelf is important in preventing interchange below 50 m. of the deeper waters at the N.E. (salinity 3·24—3·445%) and the remainder (salinity 3·12—3·288%). R. G. W.

Basin of the Río Nágima [Spain]. J. Mendizábal and M. de Cincúnegui (*Inst. Geol. Min. España*, 1941, **8**, 93—126).—Geological and hydrographical data with analyses of the H_2O supply are given. F. R. G.

Determination of the orientation of section planes of meteoritic irons. M. H. Hey (*Min. Mag.*, 1942, **26**, 141—166).—Graphical methods are described for determining the crystallographical orientation from the direction of lines of the Widmanstetter pattern and also from Neumann lines and oriented enclosures. L. J. S.

Stone-iron meteorites called pallasites: synthetic study of their structure and probable mode of formation. (Lord) Rayleigh (*Proc. Roy. Soc.*, 1942, **A, 179**, 386—393).—Pallasites consist of a sponge of Ni–Fe enclosing olivine. The structure can be closely imitated by pouring molten solder into a compact layer of stone fragments, round or angular according to the type of pallasite to be imitated. G. D. P.

Crystalline structure of chloritoid. F. Machatschki and F. Mussgnug (*Naturwiss.*, 1942, **30**, 106).—Chloritoid (sismondine, masonite) has *a* 5·4, *b* 9·4 A. The structural formula is $_{\infty}^{2}Fe^{++}(OH)_2\{(OH)_2(Fe,Al,Mg)_3[(Si,Al)_4O_{10}]\}$. A. J. M.

Tricalcium disilicate (rankinite), a new mineral from Scawt Hill, Co. Antrim. C. E. Tilley (*Min. Mag.*, 1942, **26**, 190—195).—Minute crystals of $3CaO,2SiO_2$ occur with wollastonite, larnite, and melilite in melilite-rocks and at the contact of flint nodules in metasomatised chalk (A., 1934, 505). Their identification (monoclinic, α 1·641, β 1·644, γ 1·650, 2V 64°, positive) was aided by comparison with crystals in lime-rich iron-furnace slag (SiO_2 39·47, Al_2O_3 7·96, CaO 46·39%, etc.) and in recryst. limestone fragments in glass from bottle works. L. J. S.

Lamellar structure in orthopyroxenes. N. F. M. Henry (*Min. Mag.*, 1942, **26**, 179—189).—A lamellar structure often shown by orthorhombic pyroxenes (enstatite and hypersthene) has been ascribed to the exsolution of monoclinic pyroxene in the crystal. It is now shown that the lamellæ are also orthorhombic but that their *c*-axes are slightly inclined to that of the host. L. J. S.

Orientation of Widmanstetter figures in a random section. S. Melmore (*Min. Mag.*, 1942, **26**, 167—171).—The shadow of a face of the rhombic-dodecahedron is made to coincide with the lines of the Widmanstetter figures. The method is applied to determine the orientation of the crystals in the Gibeon mass (A., 1941, I, 351). L. J. S.

Gold quartz veins of Grass Valley, California. W. D. Johnston, jun. (*U.S. Geol. Survey, Prof. Paper*, 194, 1940, 101 pp.).—The chief geological feature of the district is a body of early Cretaceous granodiorite, and the oldest rocks belong to the Calaveras formation, of Carboniferous age. The igneous rocks, other than granodiorite, include diabase, porphyrite, amphibolite schists, serpentine, gabbro, diorite, quartz porphyry, and many kinds of dyke rocks. Mining conditions are unusually favourable, and the mine waters contain mainly $Ca(HCO_3)_2$ and $CaSO_4$. Quartz (**I**) of four different types is the principal vein mineral. Au occurs both in (**I**) and in cracks in broken sulphides, principally pyrite, and the average Au content of the ore mined has been 0·25—0·5 oz. per ton. Two main stages of primary or hypogene mineralisation are recognised and described. Au is commonly associated with and contemporaneous with galena. The distribution of Au in the ore shoots is very erratic. The chemical changes in the wall rocks consisted mainly of the introduction of CO_2, K, and S, and the removal of SiO_2 and Na. The (**I**) was deposited by dil. aq. solutions in open fissures, and the vein-depositing solutions are believed to have been wholly of magmatic origin. The mines of the district are described. L. S. T.

Geology of the Konongo Gold Belt and surrounding country. T. Hirst (*Bull. Imp. Inst.*, 1942, **40**, 36—61).—Three chemical analyses of granites are recorded. L. S. T.

Genetic correlation of cinnabar and some gold–silver deposits. H. J. Fraser (*Econ. Geol.*, 1939, **34**, 468).—Cinnabar (**I**) deposits are a unique type of almost monomineralic sulphide mineralisation characterised by shallow depths of formation and probably very low temp. Au–Ag deposits of the near surface type show much greater variety of associated minerals and structural types. The metallic elements present are remarkably similar in both these types. Western (**I**) deposits contain a relative concn. of Fe, Cr, Mn, Cu, Zn, Pb, Co, Ni, Ge, As, Sb, Au, and Ag. Cu, Ag, Pb, Co, and Ge are present, apparently as solid solutions, in (**I**) in amounts $\gg$ those in the adjacent wall rock. The Au–Ag deposits generally contain Fe, Cu, Pb, Zn, Au, Ag, Sb, and Hg in amounts sufficient to form characteristic minerals. Other elements, present probably in solid solution, include Co, Mn, Cr, Ga, Ni, and Mo. The solutions forming Au–Ag deposits of the very near surface type and (**I**) deposits appear to differ chemically only in the quant. proportion of the elements present. L. S. T.

Quicksilver deposits in and near Lake County, California. C. P. Ross (*Econ. Geol.*, 1939, **34**, 467—468).—The deposits in the Mayacmas are probably Pliocene, and those of Sulphur Bank are so recent that deposition of cinnabar (**I**) is continuing. Many individual seams are lined solely with (**I**), but dolomite and SiO_2 may occur. (**I**) forms rarely by replacment. Hydrocarbons are widespread in the ore. Ni minerals in small amount are conspicuous in the Mayacmas district, and are derived presumably from the serpentine. The (**I**) lodes are almost free from other metals. L. S. T.

Evolution of the central Texas granites. S. S. Goldich (*J. Geol.*, 1941, **49**, 697—720).—Chemical analyses and petrographic data for 5 granites, a granite-porphyry dike rock (llanite), and an aplite in the Llano uplift region of Texas are recorded and discussed. A close relationship is indicated by these data, and the variation of oxides with SiO_2 content (68—77%) is shown diagrammatically. The origin of the granites, which may have been evolved by the fractionation of one or more chemically-analogous liquids, is discussed. L. S. T.

Wall-rock alteration at Night Hawk Peninsular mine, Night Hawk Lake, Ontario. A. R. Byers (*J. Geol.*, 1941, **49**, 279—291).—Ore bodies in the mine lie in or near a stock of albite syenite intruding Keewatin lavas. The deposit consists of carbonate zones carrying disseminated sulphides, and cut by auriferous quartz stringers. Geological and mineralogical features are described briefly. Carbonate alteration (ankeritisation) is the dominant type of wall-rock alteration; it has affected large vols. of the syenite, and is most intense within the zones of Au mineralisation. Development of sericite and fuchsite accompanies the carbonatisation. Chloritisation is intense near the carbonated zones. Chemical analyses of the unaltered and altered syenite show large decreases in SiO_2, Na_2O, and Al_2O_3, except with the chloritised syenite where Al_2O_3 has been added. FeO, MgO, CaO, K_2O, and S have increased. The mineralising solutions were probably very dil., hot, alkaline waters containing CO_2, alkali carbonates, and H_2S as their main constituents. The Au was transported as a double sulphide of the alkalis, or as an alkali S-salt. L. S. T.

Some minerals of the lavas of the Puy chain. Y. Bentor (*Compt. rend.*, 1941, **213**, 289—292).—Quartz is rare, tridymite more frequent, and cristobalite widespread throughout most of the acid rocks; it is magmatic in origin. Kaersutite, TiO_2 8·77, Na_2O 2·12, K_2O 0·98, and MnO 0·13%, is abundant. Pseudobrookite and orthite are also described. L. S. T.

Observation of clay minerals using the electron microscope. H. Inuzuka (*Amer. Min.*, 1941, **26**, 448—449).—Under the electron microscope, Kibushi clay shows no definite crystal forms, but a semi-transparent membrane, probably of org. matter, supporting aggregations of grains. In pure kaolinite, crystal forms, but no membrane, can be recognised. L. S. T.

Adsorbent clay found in the rhyolitic cinerites of the Bourboule (Puy-de-Dome). (Mlle.) S. Caillère (*Compt. rend.*, 1941, **213**, 489—491).—The clay is found as a syrupy mass containing ~90% of hygroscopic H_2O. The dried material consists of an intimate mixture of kaolinite and montmorillonite, both containing considerable amounts of Fe. F. J. G.

Specification of siderolithic clays subordinate to the formation of the Perigord sands, in Dordogne. J. de Lapparent (*Compt. rend.*, 1941, **213**, 111—114).—The clays of the region are associated with montmorillonite (**I**). The kaolinite group is represented either by kaolinite (**II**) or by halloysite (**III**). The (**III**) of the Dordogne district differs from that occurring elsewhere. It is almost isotropic, only weak birefringence being observable. (**I**) forms transparent masses, faintly coloured green or pink, and is easily cut with a knife. The *X*-ray diagram is similar to that given by (**I**) from other parts of the world. In some argillaceous masses (**I**) and (**II**) occur in equiv. proportions. Some green clays of this district are composed of a mixture of (**I**), (**II**), and attapulgite. A. J. M.

Origin of kaolin. W. Lindgren (*Inst. Geol. Min. España*, 1941, **8**, 87—92).—Formation of kaolin is attributed to the action of H_2O containing CO_3'' and SO_4'' on the earth's surface. F. R. G.

Kaolin deposit at Cances near Carballo (Coruña). P. H. Sampelayo (*Inst. Geol. Min. España*, 1941, **8**, 81—82).—The deposit is described. F. R. G.

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ERRATUM.

Abstracts A., I, 1942.

Page 204, lines 23 and 22 from bottom, *for* "Since . . . sequence" *read* "Since the order of inductive electron-release is known to be $Bu^{\gamma} > Pr^{\beta} > Et > Me > H$, the new results prove the sequence $Me > Et > Pr^{\beta} > Bu^{\gamma} > H$."

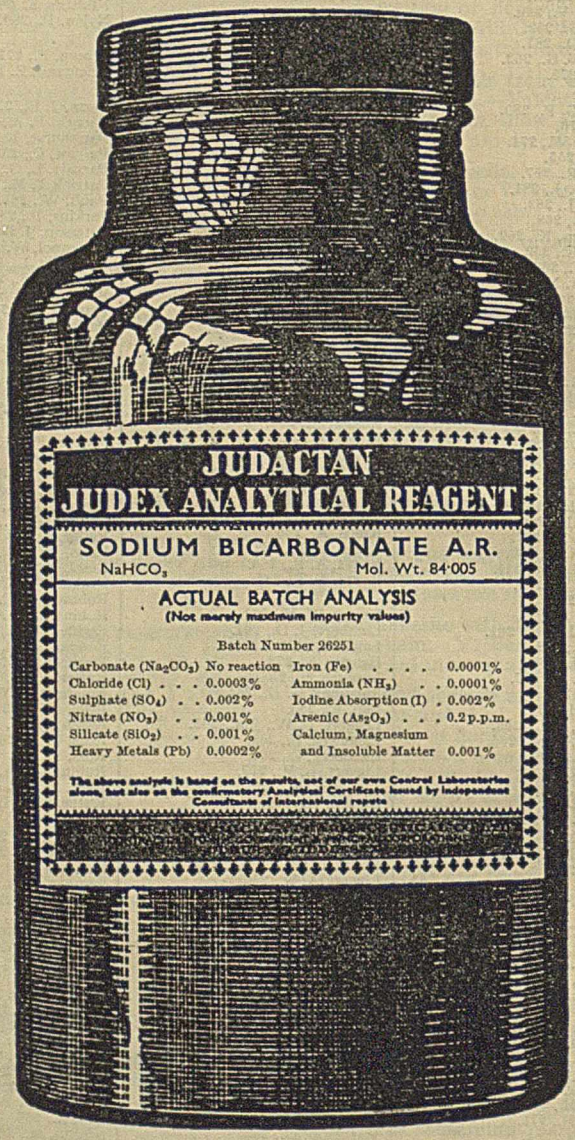
JUDACTAN

ANALYTICAL REAGENTS WITH ACTUAL BATCH ANALYSIS

ACTUAL

BATCH

ANALYSIS



Each Batch subjected to INDEPENDENT ANALYSIS before label is printed

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