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

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BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

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

AUGUST, 1943.

I.—SUB-ATOMICS.

Identification of orders and ghosts in grating spectra.—See A., 1943, I, 186.

Spectrum of neutral tungsten, W I. O. Laporte and J. E. Mack (*Physical Rev.*, 1943, [ii], **63**, 246–297).—An analysis yields 300 levels, and tentative g vals. are given to 201 of these. Configurations and L and S vals. are assigned to 65 levels, with 18 ambiguities due to a mixing of eigenfunctions. All the low levels are believed to be known. The ionisation potential is 7.94 ± 0.1 v. A rectangular array of the transitions and full data for ~2250 classified lines are given. N. M. B.

Quenching of cadmium resonance radiation (3261 A.) by hydrocarbons and other gases. E. W. R. Steacie and D. J. LeRoy (J. Chem. Physics, 1943, 11, 164—171).—Measurements of quenching of the Cd resonance line 3261 A. give the following quenching crosssections: H₂ 3.54, D₂ 1.80, NH₃ 0.052, C₂H₄ 24.9, C₃H₈ 29.1, CH₂:CHEt 35.2, (3CHMe)₂ 30.6, C₈H₆ 28.4, C₂H₂ 22.0, cyclopropane 0.71, C₂H₆, C₃H₈, n- and iso-C₄H₁₀ \sim 0.02 × 10⁻¹⁶ sq. cm. For the 2288 A. line the quenching cross-sections for C₂H₄, H₂, and C₃H₈ are in the ratio \sim 1 : 1 : 3. L. J. J.

Light of the night sky. C. T. Elvey (*Rev. Mod. Physics*, 1942, 14, 140—150).—The general spectral features of the light of the night sky are reviewed. The strongest lines are at 5577.35, 6300, and 6364 A. These are the only lines definitely assigned to radiation from atoms. Investigations in the infra-red are difficult to carry out and more determinations are needed. The chief lines found in the ultra-violet are discussed. In both non-polar and polar auroras the forbidden transitions of the O atom are found. The Na line is strong in the non-polar aurora, but is absent from the polar. Photometric observations are discussed. These observations on the strong lines in the red to green part of the spectrum give information concerning the height of the non-polar auroral layer, the nocturnal variations of intensity, and the geographical distribution of the intensity of various radiations. The Na line in auroral light is very strong during twilight and fades rapidly to a const. intensity when the instrument faces west, but the reverse is the case when facing east. Magnetic effects are discussed, and the theoretical explanations of these observations are considered. A. J. M.

Theory of particles of spin half and the Compton effect. H. J. Bhabha and D. Basu (Proc. Indian Acad. Sci., 1942, 15, A, 105– 117).—Mathematical. W. R. A.

Centrifugation of electrons. H. Klarmann (*Naturwiss.*, 1942, **30**, 424),—Cu₂O, Se, and TiO₂-phenol resin barrier-layer rectifiers rotated at 450g on the circumference of a metallic disc showed no effect on the electron density at the boundary of the semi-conductor as indicated by the characteristic lines. L. J. J.

Energy loss by radiation of fast electrons in a Coulomb field. J. C. Jaeger (*Proc. Camb. Phil. Soc.*, 1943, **39**, 127–130).—An exact solution of the problem of the energy loss by radiation of a fast electron in a Coulomb field is presented, relativistic Coulomb wavefunctions being used. Except near the short- λ limit, the discrepancy between the cross-section deduced and that obtained by the Born approximation is not great. A. J. M.

Effect of high-frequency voltage on dielectric constant of space containing electrons. S. Ghosh (*Current Sci.*, 1943, 12, 53–54).— Investigation of the variation of thermionic current of a valve with high-frequency voltage indicates that there is no dependence of dielectric const. on high-frequency voltage, but the effect observed is secondary in nature. A. J. M.

Small-angle scattering of electrons by aluminium. B. C. Dees and B. Hamermesh (*Physical Rev.*, 1943, [ii], **63**, 297-303).—The angular distribution of scattering of 46⁻⁴-e.kv. electrons by Al foil 1⁻³ × 10⁻⁵ cm. thick was investigated in the angular range $0-10^\circ$. The vals. of the mean projected scattering angle accord with theory (cf. Goudsmit, A., 1940, I, 336). The observed scattering is mainly of plural type. N. M. B.

Proposed physico-chemical unit, g./N, to be called a "Cannizzaro unit." U. Sborgi (*Gazzetta*, 1942, **72**, 293—297).—Arguments are presented for the adoption of a "Cannizzaro unit," I g./N (g. = 180 \times (A. T.)

mass or wt.; N = Avogadro no.), so that 1 Cannizzaro (1.6606 \times 10⁻²⁴ g.) = the wt. or mass of the atom of an ideal element of which 1 g.-atom has the wt. or mass of 1 g. At. wts. would then be expressed in Cannizzaro units. E. W. W.

Average H-H₂ repulsive potential from collision cross-section measurements. I. Amdur (J. Chem. Physics, 1943, 11, 157-159)... Agreement with Amdur and Pearlman's results (A., 1940, I, 89) for elastic collision cross-sections between H at 200-800 v. and H₂ at room temp. is given by the repulsive potential function V(r) = $[0.846e^{-24\cdot9r^2} + 0.211e^{-2\cdot40r^4}] \times 10^{-10} \operatorname{erg}(r \operatorname{in A.}).$ L. J. J.

Radioactive isotopes of mercury. G. Friedlander and C. S. Wu (*Physical Rev.*, 1943, [ii], **63**, 227-234).—A detailed account of results previously reported (cf. A., 1942, I, 128). N. M. B.

Nuclear energy levels in ⁵⁶Fe from the decay of ⁵⁶Mn and ⁵⁶Co. L. G. Elliott and M. Deutsch (*Physical Rev.*, 1943, [ii], **63**, 321– 322).—A study of the photo-electrons produced in Pb by the γ -rays from ⁵⁶Mn confirms γ -rays of energy 0.845 \pm 0.015 and 2.13 \pm 0.05 Me.v., and shows an additional γ -ray of energy 1.81 \pm 0.04 Me.v. A consistent disintegration scheme is presented. ⁵⁶Co emits γ -rays of energies 0.845 \pm 0.015 (identical with that from ⁵⁶Mn), 1.24 \pm 0.04, and 3.4 \pm 0.2 Me.v., and others of lower abundance in the range 1.5—3 Me.v. The max. positron energy is 1.50 \pm 0.05 Me.v., and each positron is accompanied by a 1.24- and a 0.845-Me.v. γ -ray in cascade. If ⁵⁶Fe = 55.9572, then ⁵⁶Mn = 55.9612 and ⁵⁶Co = 55.9621. The threshold for a (p, n) reaction on ⁵⁶Fe should be 5.5 Me.v. N. M. B.

Nuclear energy levels. K. M. Guggenheimer (*Proc. Roy. Soc.*, 1942, A, 181, 169–182).—The formula for the energy levels of the rigid rotator has been applied to nuclei. The existence of simple rational relations between excitation levels of a nucleus, predicted by the rotator formula and empirically known in some heavy nuclei, has been confirmed in other nuclei. The vals. of the nuclear radii deduced are in conformity with vals. found by other methods. G. D. P.

Strong coupling mesotron theory of nuclear forces. R. Serber and S. M. Dancoff (*Physical Rev.*, 1943, [ii], **63**, 143—161).—Mathematical. In the theory developed, based on the assumption that interaction between a nuclear particle and the mesotron field is strong, the two types of mesotron field, charged scalar and neutral pseudoscalar, are considered. Results for the latter, for large enough separation, are of the type obtained from perturbation theory. At closer approach the forces become ordinary (non-spindependent). Spin-dependent forces extending to small separations and of sufficient strength to account for the properties of the deuteron cannot be obtained. N. M. B.

Time distribution of cosmic rays. V. Sarabhai (Proc. Indian Acad. Sci., 1942, 15, A, 89–104).—Arrival of cosmic rays on Geiger counter arrangements follows a law predictable from complete time randomness. Their behaviour is similar to that of radiations from radioactive sources. W. R. A.

Cloud-chamber and counter studies of cosmic rays underground. V. C. Wilson and D. J. Hughes (*Physical Rev.*, 1943, [ii], **63**, 161— 171; cf. A., 1939, I, 175).—Measurements with a counter-controlled cloud chamber and two counter coincidence sets in a mine at depths of 71, 141, 582, and 657 m. H_2O -equiv. are easily interpreted if it is assumed that underground the primary rays are mesotrons, and the soft rays and showers are electronic secondaries produced by the penetrating mesotrons. N. M. B.

Cosmic-ray stars at 10,000 feet. W. E. Hazen (Physical Rev., 1943, [ii], 63, 213—214).—A preliminary survey of 8500 photographs with a cylindrical cloud chamber containing eight 0.7-cm. Pb plates separated by 2.5-cm. air spaces showed 58 stars, two originating in the gas and 56 in the Pb plates. The no. of penetrating particles was \sim 19,000. Results are discussed with reference to available data. N, M. B.

Nature of the primary particles responsible for cosmic-ray phenomena. W. F. G. Swann (*Physical Rev.*, 1943, [ii], **63**, 210-211; cf. A., 1942, I, 36).—Mathematical. Conditions are satisfied by a primary particle of proton mass and single electronic charge splitting into 10 mesotrons. Intensity-zenith angle considerations indicate that there may be two types of primaries: protons responsible 190 for the generation of mesotrons at sea level and at medium altitudes, and heavier particles, possibly singly ionised He atoms, resulting through their offspring electrons in the special features of the broad intensity-zenith angle curves for high altitudes. N. M. B.

Atom-annihilation hypothesis as to the origin of the cosmic rays. R. A. Millikan, H. V. Neher, and W. H. Pickering (*Physical Rev.*, 1943, [ii], **63**, 234—245).—Tests over wide latitudes confirm the successive incidence of bands of rays due to annihilation of Si, O, N, C, and He atoms. There is further evidence for the transformation of the complete rest-mass energy of an atom into an electron pair (cf. A., 1942, I, 287). N. M. B.

Stability of principal periodic orbits in the theory of primary cosmic rays. J. Lifshitz (J. Math. Phys. Mass. Inst. Tech., 1942, 21, 284—292).—Mathematical. N. M. B.

II.—MOLECULAR STRUCTURE.

Vibration-rotation energies of the linear X-Y-Z type molecule. A. H. Nielsen (*J. Chem. Physics*, 1943, **11**, 160–163).—Mathematical. Nielsen's method (A., 1942, I, 131) is used and expressions for the XY_2 type mol. are derived from the results. L. J. J.

Convergence limit in C₂ spectrum. L. Gerō and R. Schmid (*Naturwiss.*, 1942, **30**, 420).—The convergence limit of the C₂ ${}^{1}\Pi \rightarrow {}^{1}\Pi$ system at 35,900 cm. ${}^{-1}$ above the lower ${}^{1}\Pi$ state, reported by Herzberg and Sutton (A., 1940, I, 281), is a spurious effect produced by extensive homogeneous perturbations of the upper ${}^{1}\Pi$ term in the higher vibration states, giving smaller rotational and vibrational consts. L. J. J.

Thermal excitation of pure band-emission. A. Gatterer (Naturwiss., 1942, 30, 421).—A pure band spectrum free from at. lines can be obtained by saturating a short C cylinder ~ 5 mm. in diameter with a test salt solution, drying, and passing a current of 200—300 A. The portions of the flame produced most remote from the C are the purest. Very complete band spectra of all the rare earth elements, including Ho, Er, Tu, and Yb, have been obtained.

Flame spectra in the photographic infra-red. A. G. Gaydon (*Proc.* Roy. Soc., 1942, **A**, 181, 197–209).—Spectra of flames of H_2 , CH_4 , and CO burning with O_2 and NO have been photographed in the region 6000 to 10,000 A. All flames in which H_2O is a final product show a system of emission bands from the red to the far infra-red which are shown to be due to the vibration-rotation spectrum of H_2O . The top of a flame of O_2 burning in H_2 is coloured red by the emission of these bands. The strength of these bands in the flame of moist CO indicates that the excitation is a result of the combustion process. In the H_2 -NO flame new band structure in the infra-red is assigned to an extension of the NH₃ a-band. The CH₄-NO flame also shows the NH₃ a-band and strong emission of the red system of CN.

G. D. P

Infra-red and Raman spectra of polyatomic molecules. XIX. Acetaldehyde and tetradeuteroacetaldehyde. J. C. Morris (*J. Chem. Physics*, 1943, 11, 230–235).—Data between $\lambda\lambda \ 3\mu$. and 25 μ . are recorded and analysed. Vals. are assigned to 6 fundamental stretching, 5 bending, and 3 rocking frequencies, and to the restricted internal rotation. The barrier restricting internal rotation is calc. as ~2100 g.-cal. L. J. J.

Ultra-violet absorption spectra of tagetone and related ketones. T. G. H. Jones and F. N. Lahey (Univ. Queensland Papers, Dept. Chem., 1942, 1, No. 22, 3 pp.).—Woodward's rules (A., 1941, II, 197; cf. Evans et al., A., 1942, I, 81) are extended to compounds containing C:C:C:CO. The second C:C in C:C:CO:C:C has no effect. Absorption spectra are recorded for tagetone [max. at 269 (ϵ 20,000) and 344 m μ . (ϵ 105)], crotonylideneacetone ($\Delta^{\gamma\epsilon}$ -n-heptadien- β -one) [max. at 273 (ϵ 16,800) and 340 m μ . (ϵ 123)], ψ -ionone [max. at 294 m μ . (ϵ 24,500)], $\beta\zeta$ -dimethyl- $\Delta\eta$ -n-octen- δ -one [max. at 280 m μ . (ϵ 70) and in the far ultra-violet], and $\beta\zeta$ -dimethyl-n-octan- δ -one [max. at 2855 m μ . (ϵ 60)]. R. S. C.

Spectrographic study of evodionol and its derivatives. F. N. Lahey (Univ. Queensland Papers, Dept. Chem., 1942, **1**, No. 21, 7 pp.).— Absorption spectra are detailed for evodionol (**I**) and its derivatives (cf. A., 1943, II, 241). They confirm conclusions of Morton *et al.* (A., 1940, I, 402) for the rottlerin (**II**) series and support the structures suggested for these substances. Figures below refer to absorption max. in EtOH. Substitution of COMe at $C_{(a)}$ of 5 : 7-dihydroxy-2 : 2-dimethylchroman (**III**) ~345 (ϵ 3250) and 293 mµ. (ϵ 21,000). Methylation of one, and still more of both, OH vicinal to COMe depresses ϵ and slightly displaces the max. to shorter λ : cf. the 5-Me (dihydroevodionol) (**IV**) ~333 (ϵ 3750) and 288 mµ. (ϵ 15,600), 7-Me ~332 (ϵ 3400) and 292 mµ. (ϵ 18,400), and 5: 7-Me₂ ether (dihydromethylevodionol) (**V**) of (**III**) 273 mµ. (ϵ 6700). Replacement of the chroman by a 1: 2-benzpyran nucleus causes a new, very intense band at ~262 mµ. and slight displacement of other bands: e.g., (**I**) 350 (ϵ 4000), ~224 (ϵ 9000), and 262 mµ. (ϵ 44,000) and (**V**) and (**V**). Replacement of COMe by CO·CH:CHPh greatly alters the absorption : e.g., the CHPh: derivative of (I) 389 (ϵ 10,900), 312 (ϵ 25,800), and 281 m μ . (ϵ 24,200), of (IV) ~386 (ϵ 8750) and 333 m μ . (ϵ 21,300), of (VI) 362 (ϵ 4000) and 290 m μ . (ϵ 27,000), and of (V) 292 m μ . (ϵ 10,700). Fusion of a chroman and pyran ring has little effect : e.g., 5-methoxy-8: 8-dimethyl-1: 2-pyrano[3:2-g]flavanone 345 (ϵ 4000), 290 (weak) (ϵ 11,500), and 261 m μ . (ϵ 37,000), and its 6: 7-H₂-derivative 341 (ϵ 3000) and 288 m μ . (ϵ 18,500). The data of Morton et al. (loc. cit.) for (II) were probably for a solution in hexane; in hexane a new max. is found at 400 m μ .; in EtOH this is located at 415 m μ . (ϵ 17,600) and the max. at 294 and 350 m μ . are replaced by one at 300 m μ . (ϵ 38,400). Absorption in the (I) series is the same in hexane as in EtOH. R. S. C.

 $\alpha\beta$ -Unsaturated amino-ketones. IX. Colour and constitution.— See A., 1943, II, 232.

Absorption and resonance in dyes. L. G. S. Brooker (Rev. Mod. Physics, 1942, 14, 275-293).—General views on the relation of colour to chemical constitution are first reviewed. The vinylene shift, and the relation between it and degeneracy of the extreme resonance structures, are discussed from comparison of absorption curves of the cyanines and the corresponding anhydro-bases. The deviation in the absorption max. of unsymmetrical cyanines, its variation with chain length, and its relationship to the vinylene shift are considered. Since the deviation depends on the relative basic strengths of the two terminal groups it is possible to arrange heterocyclic nuclei in order of basicity from measurements of the deviation. The deviations of unsymmetrical carbocyanines are also considered. The presence of a C_6H_6 ring in the conjugated chain causes suppression of degeneracy, and another method of obtaining the relative basic powers of heterocyclic nuclei is based on this fact The results of the two methods show good agreement. The basic power of nuclei is largely due to additional resonance stabilisation. Dyes may be classified according to the degeneracy of the extreme resonance structures. Reasons why symmetrical cyanines derived from different heterocyclic nuclei absorb at different $\lambda\lambda$, even when the length of chain is the same, are advanced. Additional double bond stabilisation is a factor which contributes to the stability of dipolar structures in dyes. A. J. M.

Effects of environment and aggregation on the absorption spectra of dyes. S. E. Sheppard (*Rev. Mod. Physics*, 1942, 14, 303-340).— The effect of the solvent on the absorption spectra of merocyanine and 1: 4-diaminoanthraquinone is discussed with regard to the polar nature of the solvent and its acidity or basicity. Both nonpolar and polar solvents displace λ_{max} to longer $\lambda\lambda$. Ionised cyanines are also considered. The aggregation of dyes in aq. solution is discussed; it has been found that examination of absorption curves does not reveal the degree of association. Electrochemical methods give the average order of association. The nature of the aggregate in H₂O is discussed. Steric hindrance supports the dimerisation theory to some extent. It is probable that a H₂O mol. participates in the structure of the aggregate, possibly being centrally co-ordinated between two cyanine cations. It is considered that dimeride formation accounts for the spectral deviations. The phthalocyanines show similar behaviour. The adsorption of acid dyes to Ag halides is considered, with reference to optical sensitisation. There appears to be a resonance stabilisation of the adsorbed dye as compared with the dissolved dye mol. In an adsorbed monolayer dimerisation probably occurs. The existence of mesophases is discussed. Heteropolymerisation in the mesophase and the heat of mesophase formation are considered. The spectra of crystallising dyes and of liquid dyes are dealt with. A. J. M.

Colour and constitution of polymethine dyes. K. F. Herzfeld and A. L. Sklar (*Rev. Mod. Physics*, 1942, 14, 294-302).—Theoretical. The connexion between colour and constitution of polymethine dyes is discussed on the basis of the Heitler-London-Slater-Pauling valency bond method. Both symmetrical and unsymmetrical ions are considered. A. J. M.

Absorption spectra of carotenoids.—See A., 1943, III, 517.

Quantum yield of diacetyl fluorescence. G. M. Almy and P. R. Gillette (*J. Chem. Physics*, 1943, **11**, 188-195).—A quantum yield of 0 145 \pm 0.03, which is independent of pressure, has been found with exciting $\lambda\lambda$ 4047 and 4358 A. λ 3650 A. gives a quantum yield varying with pressure from 0 at zero pressure to nearly the above val. at 5 cm. The pressure effect is ascribed to predissociation at a level between those reached in excitation by λ 3650 and λ 4047 A.

Raman effect. CXI. Saturated heterocyclic compounds. K. W. F. Kohlrausch and A. W. Reitz (Z. physikal. Chem., 1940, **B**, 45, 249—271).—Raman spectra are given for $(CH_2S)_3$, pyrrolidine, N-methyl-, -ethyl-, and -phenyl-pyrrolidine, $(CH_2)_3NH$, $[CH_2]_3O$, and $[CH_2]_4O$. Polarisation data are also given for the last four compounds. Symmetry classes and the influences of bonding on characteristic vibration $\nu\nu$ are discussed. W. R. A.

Raman spectrum and molecular vibrations of nitric and monodeuteronitric acids. O. Redlich and L. E. Nielsen (J. Amer. Chem. Soc., 1943, 65, 654—660).— DNO_3 was prepared by adding D_2O to N_2O_4 and has ρ^{15} 1.5228, m_1^{10} 1.3909 (HNO₂ 1.3920). Raman spectra of HNO₃ and DNO₃ are given and compared. All nine fundamental were found in both spectra and are in accord with the isotopic product rule formula applied to a plane configuration of symmetry R.A.

Baman spectra of hydrocarbons. II. 3-Methyl- Δ^{a} -heptene and i-methyl- Δ^{a} -heptene. F. F. Cleveland (J. Chem. Physics, 1943, 11, 227-230; cf. A., 1943, I. 116).—Raman frequencies, intensities, and depolarisation factors are recorded. L. I. I.

Raman effect and hydrogen bonds. VIII. Solutions of coumarin in mineral acids. G. V. L. N. Murty and T. R. Seshadri (Proc. Indian Acad. Sci., 1943, 17, A 55-57).—Solutions of coumarin in mineral acids give the Raman C.O frequency at lower wave no.; this is attributed to formation of complexes by means of H bonds. W. R. A.

Molar polarisations in extremely dilute solutions. R. Davis, H. S. Bridge, and W. J. Svirbely (J. Amer. Chem. Soc., 1943, 65, 857-862).—Dipole moments of 8 org. compounds have been determined in $C_{q}H_{q}$ or dioxan. Abnormal behaviour of P_{q}/N_{q} curves in very dil. solutions is due to experimental errors, the nature of the abnormality depending on the sign of error in P_1 .

Dielectric dispersion and absorption of water and organic liquids. W. P. Connor and C. P. Smyth [J. Amer. Chem. Soc., 1943, 65, 382— 389].—Dielectric const. and absorption of H_4O (0—100°) and 16 org. liquids (25°) were measured using λ 9.72 cm. η of the org. liquids are given. The relaxation time of the mol. was calc. from the absorption and used to calculate ΔG , ΔH , and ΔS of activation of rotation of H_2O on the abs. reaction rate theory. The vals. obtained are comparable with those calc. from viscous flow. Polarisation of H_2O is due to mol. orientation, not to proton transfer. Relaxation times of org. mols. increase with size and deviation from spherical form, and are related to viscous flow of the liquid. R. A.

Influence of hindered molecular rotation on dielectric constants of water, alcohols, and other polar liquids. G. Oster and J. G. Kirk-wood (J. Chem. Physics, 1943, 11, 175-178). - The authors' general theory of dielectric polarisation of polar liquids (A., 1940, I, 10) is applied to H O and aliphatic alcohols. A function (g), which measures the orientational correlation between neighbours in a liquid, is derived from quasi-rigid co-ordination models. Vals. calc. from the theory for ϵ of H₂O agree with observed vals. at 25° and differ by ~13% at 83°. With alcohols agreement is less close. Vals. are calc. for g for a no. of other polar liquids; g is related to thermo-dynamic abnormality. dynamic abnormality. L. J. J.

Dipole moment and molecular structure. V. Dipole moments of derivatives of ethylene glycol and glycerides. S. D. Gokhale, N. L. Phalnikar, and S. D. Bhawe (J. Univ. Bombay, 1943, 11. A. Part 5, 56-62).—Dipole moments in C₆H₆ solution are recorded for OH-[CH₂]₂-OMe (2·20). OH-[CH₂]₂-OEt (2·22). OH-[CH₂]₂-OAc (2·34). (CH₂-OAc), (2·32). OAc-[CH₂]₂-OMe (2·13). OAc-[CH₂]₂-OAc (2·25). C₁₂H₂₇-CO-O-[CH₂]₂-OEt (2·13). OAc-[CH₂]₂-OAc (2·02). C₁₂H₃₇-CO-O-[CH₂]₂-OEt (2·13). (C₁₃H₃₇-CO-O-[CH₄]₃-OMe (2·02). C₁₂H₃₅-CO-O-[CH₂]₂-OEt (2·13). (C₁₃H₃₇-CO-O-[CH₄]₃-OMe (2·03). (C₁,H₃₅-CO-O-[CH₂]₂-OEt (2·13). (C₁₃H₃₇-CO-O-CH₄)₃ (2·30). (C₁,H₃₆-CO-O-(CH₂)₂ (2·26), monostearin (3·04), monomyristin (2·99), (CH₄-CO₄Et)₂ (2·38 D.). The results are in accordance with the views of Clarkson and Malkin (A., 1934, 720) on the structure of the trigivcerides. F. R. G. the triglycerides. F. R. G.

Electric moments of σ -substituted phenols and anisoles. I. Halo-gen derivatives. W. F. Anzilotti and B. C. Curran (*J. Amer. Chem.* Soc., 1943, 65, 607-611).—Vals. of μ for σ -fluoro-, -chlero-, and -bromo-anisole and for σ -C₆H₆Cl-OEt in C₆H₆ suggest that the doublebond character of the ring-to-O bond is sufficient to lock these mols. to a trans-configuration. In CCl₄ the vals. of μ for o-fluoro-, -chloro-, and -bromo-phenol show that 85-90% of the mols. have the OH in the cis-position, owing to intramol. H bonding. Vals. of μ for dioran solutions are > those for C₆H₆ or CCl₄, and it is suggested that dioran forms H bonds with trans-mols. and upsets the cis-trans equilibrium. The order of bond strengths in the phenols is H--F > H--Cl > H--Br. W. R. A.

Quantisation of molecules, inter- and intra-molecular forces. K. Fajans and T. Berlin (*Physical Rev.*, 1943, [ii], **63**, 309–312, 399; cf. A., 1943, I, 81).—The quantisation of the electrons of the at. cores and of the valency electrons is distinguished. The latter can be quantised with respect to the field of both cores (shared electrons) and to the field of single cores (unshared electrons). Consequences N.M.B. are discussed.

Donor-acceptor bonding. I. Etherates of boron trifluoride. A. W. Laubengayer and G. R. Finlay (J. Amer. Chem. Soc., 1943, 65, 834—839).—Donor-acceptor bonding in Me₂O,BF₃ (I), Et₂O,BF₃ (II), and MeOEt,BF₃ has been examined. Mol. vols. are < the combined mol vols. of the ether and BF₃. Saturated v.p. of the three etherates have been measured. Heats of formation of (\mathbf{I}) and (\mathbf{II}) , and heats of dissolution of BF₂ and (\mathbf{I}) in H₁O, and of BF₂ and (\mathbf{II}) in Et₂O, have been determined calori-metrically. The heat of dissociation of (\mathbf{I}) has been determined from v.d. measurements. Cryoscopic mol. wt. determinations in C. H. idicate that the observation of the distoct the disto C.H. indicate that the substances are monomeric in solution. Dipole

moment measurements in C.H. show that the bond moment of B-O is small. W. R. A.

 (A) Stereochemistry of co-ordination number eight. L. E. Marchi,
 W. C. Fernelrus, and J. P. McReynolds. (B) Optical activity of potassium tetra-oralato-uranium-IV. L. E. Marchi and J. P. McReynolds (J. Amer. Chem. Soc., 1943, 65, 329-333, 333-335).
 --(a) Isomeride tables of mono- and bi-dentate groups of compounds of co-ordination no. 8 are given for 4 different configurations.

(a) Four optically active isomerides of $K_4[U(C_sO_4)_4]$ have been found, two stable and two racemising easily. Cubic and trigonal prism configurations (with two extra bonds along the unique axis) are thus impossible for the compound, but the square Archimidean antiprism or the dodecahedron (triangular faces, symmetry Va) are possible. W. R. A.

Structure of Mo CN - C. Racah (J. Chem. Physics, 1943, 11. 214).—It is shown that 8 equiv. non-cylindrical bond functions can be constructed by s-p-d hybridisation. The bond functions can in two sets making angles 34 33' and 72° 47' with the *z* axis and having strengths 2.9954 and 2.9696, respectively. L. J. J.

S. T Calculations of univalent ionic radii and ionic refractions. Li (J. Chinese Chem. Soc., 1941, 8, 143–146; cf. A., 1941, 1, 191).—Univalent ionic radii are calc. from the equation $R_u = k(0.32 + n/50)n^3 Z^{-1} z^{-(n-2)/50}$, where Z is the at. no., z the $R_{\rm g} = R(0.32 + \pi) 00) \pi^2 Z^{-4} Z^{(\alpha-1)(\alpha)}$, where Z is the at. no., z the valency, π the principal quantum no., and k is 1.44 for non-rare-gas type ions, and 1.00 for rare-gas type ions, whence $([R]/0.603)^{2/3} = k'R_{\rm g}$, where [R] is the ionic refraction and k' is 1 for non-rare-gas, and 1.19 for rare-gas type ions. Vals. of $R_{\rm g}$ and [R] are tabulated and are comparable with those of other authors. F. R. G.

Structure of the protein molecule. D. G. Dervichian (J. Chem. Physics, 1943, 11, 236-246).- A two-dimensional double layer of NH₂-acids is postulated as the constitution of proteins in solution. The shape and size of a protein mol. of mol. wt. \sim 3500 can be estimated from the size of a single NH₂-acid residue. Denatured mols. may have a filamentous or fibrous form, characterised by the polypeptide chain. L. J. J.

III.—CRYSTAL STRUCTURE.

due to thermal waves cannot be obtained on a plane of zero structure factor. The atoms move rigidly under the effect of thermal waves. N. M. B.

Higher-order terms in the diffraction of X-rays by crystals. L. Bonnelance and K. Bleuler (Arch. Sci. phys. nat., 1942, [v], 24, Suppl., 213-216; cf. preceding abstract).-Mathematical. The continuous supplementary electron density distribution due to thermal perturbation is calc. A diminution of thermal diffusion of X-rays with rise of temp. outside the Bragg angle is noted as a new effect influencing the interpretation of experimental results.

N. M. B. New concepts of the solid state. (Sir) C. V. Raman (Proc. Indian Acad. Sci., 1942, 15, A, 65-72).—An address. W. R. A.

Crystallographic properties of electric furnace boroaluminate.-See B., 1943, I, 288.

Glass systems. X-Ray analysis of sodium chloride dissolved in boron trioxide glass. S. K. Majumdar and R. M. Palit (J. Indian Chem. Soc., 1942, 19, 461-466).—The lattice distance of NaCl dis-solved in B_0O_3 glass, determined by the Debye-Scherrer method, is 9-088 A., which is 66% > the normal val. This discrepancy is discussed theoretically, and the increase is ascribed to the effect of the dielectric const. of the medium; this tends to decrease the Coulomb forces of attraction, but to leave the repulsive forces practically A. J. M. nnaffected

Structure of liquid carbon tetrachloride. A. Eisenstein (Physical Rev. 1943, [11], 63, 304-308).—A Fourier analysis of corr. X-ray diffraction patterns obtained at 27° by photographic and Geiger-Muller counter methods gives the electron density distribution function for the liquid. C-Cl and Cl-Cl distances within the mol. are shown, and intermol. distances and concns. are indicated. The latent heat of vaporisation (6:24 kg.-cal. per g.-mol.) calc. from the distribution function is in fair agreement with experiment (7.09 kg.-cal. per g.-mol.). N. M. B.

Symmetry and physico-chemical properties of crystallised com- Bounds, II. General structural principles of organic compounds.
 W. Nowacki (Helv. Chim. Acta, 1943, 26, 459-462; cf. A., 1942,
 I, 389].—Theoretical. The space-groups available to substances having mols. of a low degree of symmetry and weak intermol. forces are enumerated. F. J. G.

Diffraction of X-rays by sodium stearate at room temperature. J. W. McBain, A. de Bretteville, jun., and S. Ross (J. Chem. Physics, 1943, 11, 179-183).—Re-examination of the a-form of Na stearate examined by Thiessen and Stauff (A., 1936, 1186) gives X-ray data

H 2 (A., I.)

in agreement (some earlier data are corr.). The present vals., $a 8.03 \pm 0.03$, $b 9.22 \pm 0.02$, $c 52.1 \pm 0.3$ A., give $\rho_{calc.}$ 1.052. The monoclinic β -form obtained by heating the a-form at $>54^\circ$ gives $a 8.7, b 5.1, c \sin \beta 46.6 \text{ A.}, \beta 63^\circ$, $b/a \sin \beta 0.66, \rho 0.99$ for 4 mols. per unit cell. Fusion and cooling gives a new (γ) form, with long spacing 44.6 A.

Structure of p-dibromobenzene as determined by Fourier analysis. S. Bezzi and U. Croatto (Gazzetta, 1942, 72, 318–335).—p-C₆H₄Br₂ has been shown (Bezzi et al., Rend. Ist. Ven. Lett. Sci. Arti, 1941— 42, 101, ii, 237) to crystallise in space-group C_{2h}^{5} —P2₁/a, the unit cell containing 2 mols., and having a 15·36, b 5·75, c 4·10 A., β 112° 30′ The parameters for Br (x_{Br} 0·168, y_{Br} 0·169, z_{Br} 0·974) obtained by Patterson projection are confirmed by Fourier projection on planes (001) and (010), which also gives the parameters for C₍₁₎, C₍₂₎, and C₍₃₎. The structure is represented perspectively. The distance Br—Br (same mol.) is 6·50 A., the min. distance Br—Br (different mols.) 3·76 A., and the distance between Br and linked C is 1·84 A. E. W. W.

Fine structure of lignins. R. Jodl (Brennstoff-Chem., 1942, 23, 163-169, 178-181).—X-Ray examination showed that cuproxamlignin (I) crystallites are ~9 A. high and ~16 A. in diameter. Three layers 3.9 A. apart are arranged one above the other in the crystallite. Lignin, like other humic substances, must be regarded as a lamellar disperse system. Lignin was found to have a d of 1.41; the H₂O vapour isotherms indicated that H₂O is bound both by lyosorption and by capillary condensation, as in humic substances. (I) contained 7 g. of lyosorption H₂O and 27 g. of capillary H₂O per 100 g. of dry lignin. Lignin represents a polycapillary system with pores 30-20,000 A. in diameter; the surface area is ~180 sq. m. per g. The microscopical picture of a transverse or longitudinal section of wood cells indicates that the lignin and cellulose are interwoven in a structure finer than the λ of light. Lignin is not hydrophilic but is organophilic and cannot be regarded as a homogeneous compound of fixed mol. wt. R. B. C.

Donor-acceptor bonding. II. Electron diffraction of dimethyl ether-boron trifluoride. S. H. Bauer, G. R. Finlay, and A. W. Laubengayer (*J. Amer. Chem. Soc.*, 1943, **65**, 889–8895; cf. A., 1943, I, 193).—The best model of Me_2O,BF_3 has B valency angles tetrahedral and the ether portion unchanged, although the C—O distance may increase to 1.44 A. B—F and B—O distances are 1.41 ± 0.02 and 1.52 ± 0.06 A. Models having one or more O valency angles of 120° cannot be completely excluded. Energetics of the association suggest sharing of an electron pair, not dipole-dipole interaction, as the mechanism of bond formation. W. R. A.

Thermodynamics of crystal lattices. I. Discussion of the methods of calculation. M. Born. II. Calculation of certain lattice sums occurring in thermodynamics. M. Born and M. Bradburn. III. Equation of state for a face-centred cubic lattice. M. Bradburn (*Proc. Camb. Phil. Soc.*, 1943, 39, 100—103, 104—113, 113—127).— I. A discussion of the problems involved in the theoretical investigation of stability conditions of crystal lattices is given. The general method of attack of the problem in future papers is outlined.

II. A method of calculating lattice sums of the type required in discussing the stability of cubic crystals of the Bravais type, involving the phases of the waves, is developed. Tables of the lowest lattice sums have been computed.

III. The equation of state for the simplest stable crystal, the cubic face-centred lattice, is determined. The result is compared with those obtained using rough approximations in order to get an estimate of the degree of reliability of the latter. A. J. M.

Electronic energy bands in (A) body-centred iron. M. F. Manning. **(B) Face-centred iron.** J. B. Greene and M. F. Manning (*Physical Rev.*, 1943, [ii], **63**, 190—202, 203—210).—(A) Calculations by the Wigner-Seitz-Slater method are reported. There are two filled and four partly filled bands; the two lowest filled bands for ferro-magnetism, and the highest band for electrical conduction. The width of the occupied levels is ~ 0.6 Rydberg. The density of states, calc. as a function of energy, is 17 at the highest occupied energy level, compared with 11.4 electrons per atom Rydberg for face-centred Fe, the higher val. accounting for the ferromagnetism of body-centred Fe. This higher sp. heat is responsible for the high-temp. change from face-centred to body-centred structure.

(B) Similar calculations for face-centred Fe show two filled and four partly filled bands. The calc. density of states-energy curves closely resemble that for body-centred Fe. Results are used to calculate the average Fermi energy as a function of the total no. of valency electrons, to investigate the ferromagnetism of Ni and Co by calculating the change in Fermi energy as a function of the no. of uncompensated spins, and to calculate the electronic sp. heat at high temp. This val agrees fairly well with the difference from 3R of the experimental sp. heat. N. M. B.

Structure of rolled and annealed aluminium as revealed by X-rays. E. E. Spillett (J. Inst. Metals, 1943, 69, 149–175).—The orientation developed in commercial Al sheet by cold-rolling from a hot-rolled blank without intermediate annealing usually approximates to (112) fibring; an intermediate anneal gives a more uniform product by removing inhomogeneity derived from the earlier hot-roll. Recrystallisation of hard-rolled Al begins and ends in the surface layers at lower temp. than in the centre, but this effect is minimised by an intermediate anneal at 360°, which also reduces the recrystallisation temp. of the final product, whereas an intermediate anneal at 500° raises it. Commercial cold-rolled Al recrystallises with random orientation unless the Fe content is high, in which case the rolling orientation may persist after annealing. With Al of high purity annealing may produce preferential recrystallisation, accompanied by marked preferred orientation in which a cube face lies in the rolling plane and a cube edge in the rolling direction. The lattice spacing in hard-rolled Al strip varies throughout the thickness and in the final product is influenced by the temp, of any intermediate anneal; it increases during the mechanical softening which occurs before recrystallisation and decreases during the actual recrystallisation. A. R. P.

X-Ray study of the transformation of cobalt. O. S. Edwards and H. Lipson (J. Inst. Metals, 1943, 69, 177—188).—High-temp. X-ray photographs of pure Co powder and rod have been taken in an attempt to find the cubic-hexagonal transformation temp. Above 500° the cubic form is stable; powder remains cubic down to 300°, at which point some of the metal becomes hexagonal, but the amount so converted does not increase with time. As the temp. is further lowered more of the sample becomes hexagonal until at room temp. $\sim 5\%$ is converted; on raising the temp. no change occurs at < 500°, at which temp. all the sample becomes cubic. With rod, transformation begins on cooling at $\sim 400°$ and the metal is almost completely hexagonal at 300°; reversion to cubic again occurs fairly sharply at $\sim 500°$. It is suggested that the free energies of the two forms of Co become almost equal just below 500° so that other factors must affect the approach to equilibrium. Increase in surface energy would account for the greater ease of transformation of the rod compared with the powder. A. R. P.

IV.—PHYSICAL PROPERTIES OF SUBSTANCES.

Probable accuracy of the general physical constants. (A) F. Benford. (B) R. T. Birge (*Physical Rev.*, 1943, [ii], **63**, 212, 213).— (A) The distinction between real accuracy and consistency of data in computing an assigned val. is emphasised and illustrated by tabulated consts.

(B) A discussion of (A).

N. M. B.

Mol. wt. of rubber.—See B., 1943, II, 230.

Mean mol. wt. of bitumens.—See B., 1943, I, 272.

Electrical conductivity of lead chromate. T. W. Lashof (*J. Chem. Physics*, 1943, **11**, 196–202).—Sintered pellets of pure monoclinic PbCrO₄ have negligible contact resistance and obey Ohm's law over a wide range of voltage at temp. up to 700°. The conductivity (κ) varies with temp. by a Boltzmann-type law $\kappa \propto e^{-A/kT}$ where A = 1.48 e.v. at 350–700° and 0.60 e.v. at lower temp. k is also $\propto [O_2]^{-1/3\cdot 1}$. It is concluded that PbCrO₄ is an excess-electron semiconductor with <1% ionic conduction (Hall and Seebeck effect measurements) and activation energies 5.28 and 1.20 e.v. for the reactions 2PbCrO₄ \rightarrow Pb(CrO₂)₂ + Pb + 2O₂ and Pb \rightarrow Pb⁺ + ϵ , respectively. L. J. J.

Effect of ionic radius and cation valency on electrical conductivity of silicate melts. K. Endell and J. Hellbrügge (Naturwiss., 1942, 30, 421-422).—Measurements of viscosity (η) and sp. resistance (ρ) of silicate melts at 1250-1450° with 10-40 ion-% Li, Na, and K and with ~5 ion-% Li, Na, K; Be, Mg, Ca, Ba; B, Al, Fe, respectively, in Na₂O,2SiO₂ show that with increasing interlocking of SiO₄ tetrahedra η exceeds ρ by several orders of magnitude and increases more rapidly; when the SiO₄ network is broken down η and ρ are of the same order of magnitude. η^{-1} and ρ^{-1} increases with increasing ionic charge and decreasing Si:O ratio. ρ^{-1} increases and η^{-1} decreases with increasing cationic radius. L. J. J.

Magnetic susceptibility of the brown ferric phenanthroline complex. L. Michaelis and S. Granick (J. Amer. Chem. Soc., 1943, 65, 481–482).—The effective magnetic moments of three preps. of

 $[phenan_2 \ Fe \ OH \ Fe \ phenan_2]Cl_4 \quad (phenan = o-phenanthroline) \\ have been measured by a modified Gouy method in aq. solution and in the solid state. No indication of Fe-Fe interaction, as postulated by Gaines$ *et al.*(A., 1936, 1324), was observed. W. R. A.

Specific heats at low temperatures of magnesium ortho- and metasilicate. K. K. Kelley (J. Amer. Chem. Soc., 1943, 65, 339–341).— Sp. heats of Mg₂SiO₄ and MgSiO₅ have been measured at $51-298^{\circ}$ K.; derived vals. of $S_{298\cdot16}$ are $22\cdot7\pm0\cdot2$ and $16\cdot2\pm0\cdot2$ g.-cal. per degree per g.-mol., respectively. W. R. A.

Heat capacities and entropies of molybdenum and tungsten trioxides. H. Seltz, F. J. Dunkerley, and B. J. de Witt (J. Amer. Chem. Soc., 1943, 65, 600–602).—Vals. of C_p for MoO₃ and WO

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have been determined calorimetrically at $\sim 60-300^{\circ}$ K. and yield entropy vals. of 18.68 ± 0.3 and 19.90 ± 0.2 g.-cal. per degree per g.-mol. at 298.1° κ . ΔG equations of formation are derived. WRA

W. R. A. Heat capacity and entropy, heats of transition, fusion, and vaporis-ation, and v.p. of cyclopentane. Evidence for a non-planar structure. J. G. Aston, H. L. Fink, and S. C. Schumann (J. Amer. Chem. Soc., 1943, 65, 341-346).—Vals. of C_p for solid and liquid cyclopentane (I) have been determined calorimetrically at $11\cdot8-293\cdot82^{\circ}$ K. The following data are given : transition temp., $122\cdot39\pm0\cdot05^{\circ}$ and $138\cdot07\pm0\cdot05^{\circ}$; m.p. $179\cdot69\pm0\cdot05^{\circ}$; b.p. $49\cdot20\pm0\cdot05^{\circ}$ K.; heats of transition $1165\cdot1\pm0\cdot8$ and $82\cdot80\pm0\cdot08$; heats of fusion and vaporis-ation $144\cdot05\pm0\cdot30$ and 6982 ± 8 g.-cal.; entropies of liquid and gaseous (I) at $298\cdot16^{\circ}$ K. are $48\cdot87\pm0\cdot05$ and $70\cdot70\pm0\cdot07$ g.-cal. per degree per g.-mol. from C_p data. Entropies for possible struc-tures have been computed from spectroscopic data, and the best agreement with experimental data is given by the configuration agreement with experimental data is given by the configuration C. (one C out of plane). W. R. A.

Temperature of maximum density of heavy water. T. L. Chang and J. Y. Chien (J. Chinese Chem. Soc., 1941, 8, 74-75).—From pyknometric measurements on 99.54 mol.-% D₂O the temp. of max. d of pure D_2O is calc. as $11.21 \pm 0.05^\circ$. J. W. S.

Statistical theory of liquids. II. G. Jaffé (*Physical Rev.*, 1943, [ii], **63**, 313-321; cf. A., 1943, I, 86).—A treatment of v.p., surface tension, and the neighbourhood of the crit. point. A discrepancy (suggesting association) is found between observed and calc. heats gases and monat. metal vapours. If a "molar surface S^* " is defined as a surface containing 1 g.-mol. of the liquid, the equation of state for the surface phase is $\gamma S^* = RT$. Edvos' law follows as a limiting law for sufficiently high temp. For the neighbourhood of the crit. point the Cailletet-Mathias law is deduced, and the Kamerlingh Onnes const. is deduced from the special form of N. M. B. potential used in the theory.

Vapour-liquid equilibria for hydrocarbons. C. D. Shiah (J. Chinese Chem. Soc., 1941, 8, 123-130).—A detailed account of work previously noted (B., 1942, I, 453). Since log $K \gtrsim a - b/T$ at const. pressure, it follows that within the limits of experimental error the terms (T - and T) at which there explores the previously account of the second \hat{t} emp. (T₁ and T₂) at which two substances have equal vapourliquid equilibrium consts. (K) are related by $1/T_1 = a' + b'/T_2$. All the paraffins have a common val. of T_1 and of T_2 , and their mol. wt. is $\alpha a'$, whence the data for high mol. wt. or mixed paraffins can be deduced. F. R. G.

Distance correlations and Bose-Einstein condensation. F. London (J. Chem. Physics, 1943, 11, 203-213).-The correlation effect on mol. distance distribution in a Bose-Einstein gas is calc. as a function of vol. and temp., particularly for condensation. The negative coeff. of thermal expansion of liquid He II may be related to the increased d as seen from a single mol. for certain condensed conditions. L. J. J.

Pressure-volume-temperature relations of $aa\delta$ -trimethylpentane. W. A. Felsing and G. M. Watson (*J. Amer. Chem. Soc.*, 1943, 65, 780-781).—Compressibility of liquid $(CH_2Pr\beta)_2$ has been determined between 100° and 250°, and at pressures up to 300 atm. Vals. have also been obtained at 275°, above the crit. point.

W. R. A

Viscosity of sulphur. R. F. Bacon and R. Fanelli (*J. Amer. Chem. Soc.*, 1943, **65**, 639–648).— η of pure S at various temp. was found to be independent of the method of purification and of the rate of the method of purification and of the rate of the method. to be independent of the method of purification and of the rate of heating or cooling. Preheating S, containing 0.038% of oil, to 260° gave very low vals. of η , which increased on maintaining the S at 160°. Crude H₂S₂ reduces η , and presumably causes the diminution by org. matter, NH₃, amines, and H₂S. Halogens considerably reduce η (Cl>Br>l), the effect persisting for some time when halogenated S is heated in air at 200°. S containing a small amount of S halide or I is suggested as a heat-transfer hquid, because many metals are not attacked by it. W R A because many metals are not attacked by it. W. R. A.

Properties of liquid sulphur. R. E. Powell and H. Eyring (J. Amer. Chem. Soc., 1943, 65, 648-654). Partial insolubility of chilled S_{μ} , and the relation between η and temp. for pure S, are quantitatively explained by a thermodynamical equilibrium between S_s rings and S chains of all lengths. Reduction of η by halogens is deduced, and the pressure-variation of η predicted. Comparison with experiment supports the postulated chain-structure of S_{μ} . W. R. A.

Mechanical properties of glass.-See B., 1943, I, 286.

Thermal diffusion with ammonia. W. W. Watson and D. Woernley (*Physical Rev.*, 1943, [ii], **63**, 181-184).—A " two-bulb " experiment with NH₃ containing $\sim 15\%$ ¹⁵N to increase the accuracy of the mass spectrometer analyses shows that with decreasing temp. the thermal diffusion const. a of NH₃ changes from positive to negative vals. at about room temp. The val. of a is a linear function of log T, and the rate of decrease is nearly 8 times that for Ne and A. In a qual. discussion the effect is attributed largely to the strong firstorder dipole-dipole intermol. forces, which are $\propto 1/R^4$, where R =distance between interacting mols. N. M. B.

V.—SOLUTIONS, DISPERSIONS, AND MIXTURES.

isoPropyl alcohol-water system. Density-composition data and pyknometric technique. W. M. Langdon and D. B. Keyes (Ind. Eng. Chem., 1943, 35, 459–464).—An improved pyknometric technique, requiring <10 ml. of liquid, has been developed for determining the composition of alcohol-H₂O mixtures. The d in vac. of highly purified $Pr^{\beta}OH$ is 0.77223 ± 0.00002 g. per ml. at 35°. *d* data for the system $Pr^{\beta}OH-H_2O$ at 35° are recorded. C. R. H.

Total and partial pressures of binary mixtures of dioxan in benzene at 25°. P. C. Teague [with W. A. Felsing] (J. Amer. Chem. Soc., 1943, 65, 485–486).—Deviation from ideality is slight.

W. R. A Apparent ionic volume in infinitely dilute solutions. F. H. Lee (J. Chinese Chem. Soc., 1942, 9, 46-53).—The apparent ionic vol. in solution (v_s) and the spherical vol. of the ions in the cryst. state (v_s) are related by $v_s = av_s + b$. The parameters a and b are the same for all ions except Na' at const. temp. and increase with rising temp. The term due is repeated by an effective invite vol. temp. The term av_e is regarded as an effective ionic vol. and b as a temp. The term av_c is regarded as an encerve tend to the H₂O layer correction factor due to electrostriction of a unimol. H₂O layer J. W. S.

Apparent molal heat capacities of salts in infinitely dilute solutions. F. H. Lee and C. S. Sie (*J. Chinese Chem. Soc.*, 1942, **9**, 54-56). The apparent mol. heat capacities (C_p) of alkali metal halides can be expressed: $C_p = a - b_c r_c - b_a r_a$, where r_c and r_a are the radii of the cation and anion respectively. For Na halides the val. of the const. *a* is anomalous. The parameters b_c and b_a are attributable to the const. *a* is anomalous. the restriction in motion of $\hat{H_2O}$ mols. around the ions.

J. W. S. Diffusion of hydrogen and deuterium in palladium. II. W. Jost and A. Widmann (Z. physikal. Chem., 1940, B, 45, 285-296; cf. A., 1935, 1200).—Experimental technique and sources of error are discussed. The ratio of the diffusion coeffs. of H and D in Pd, which is $<\sqrt{2}$, is discussed in relation to the difference in the zero point energies of H and D in the Pd lattice. W. R. A.

Precipitation in single crystals of silver-rich and copper-rich alloys of the silver-copper system. F. W. Jones, P. Leech, and C. Sykes (*Proc. Roy. Soc.*, 1942, **A**, 181, 154—168).—The course of pptn. at different temp. in single crystals of the alloys was studied by X-ray diffraction methods. Pptn. is continuous at the higher temp. when the degree of supersaturation is low and discontinuous when the temp. is low and the supersaturation is high. The experimental results are considered in relation to theories of the pptn. process. G. D. P.

Hall effect and physical constants of alloys. VII. Aluminium-silver series of alloys. H. Powell and E. J. Evans (*Phil. Mag.*, 1943, [vii], **34**, 145—161).—Measurements of ρ , sp. resistance, temp. coeff. of resistance, thermoelectric power, and Hall coeff. have been made on 18 annealed Ag-Al alloys covering the whole computed the series of the se on 18 annealed Ag-Al alloys, covering the whole composition range. The results are discussed in relation to the equilibrium diagram for the system; Petrenko's diagram (cf. A., 1905, ii, 635) is largely confirmed, but an additional phase boundary is detected at ~ 85 A. J. E. W. wt.-% Ag.

Solubility product of barium chromate at various ionic strengths. G. L. Beyer and W. Rieman III (J. Amer. Chem. Soc., 1943, 65, 971–973).—The solubility product of $BaCrO_4$ at ionic strengths up to 0.25 has been determined and vals. agree well with the extended W. R. A. Debye-Hückel equation.

Aqueous solubilities of r- and l-mandelic acids and three O-acyl-r-mandelic acids. W. R. Angus and R. P. Owen (J.C.S., 1943, 231-232).—The aq. solubilities of r-mandelic acid (I) and of acetyl-. propionyl-, and benzoyl-r-mandelic acids over the range $0-50^{\circ}$ and of *l*-mandelic acid (II) over the range $25-70^{\circ}$ are recorded. The substituted acids and (II) are much less sol. than (I). The data fall into line with the solubilities of other geometrical and stereo-isomerides in that the form with the lower m.p. is the more C. R. H. sol.

Iron pentacarbonyl as a solvent and reaction medium. M. T. Harrington (*Iowa State Coll. J. Sci.*, 1942, **17**, 74—76).—AsCl₃, PCl₃, and many org. compounds are sol. in Fe(CO)₅ at room temp. With amines and N_2H_4 , Fe(CO)₅ forms blood-red complexes of syrupy consistency which are unstable and decompose in air. The reaction involves aither substitution or addition, the products with involves either substitution or addition, the products with NH₂Bu^a and NH₂Et being the *compounds* $Fe(CO)_{s}$,4NHBu^a and Fe(CO)_s,4NEt₃, Free Fe could be obtained from Fe(CO)₅ only by heating at $\sim 200^{\circ}$. Fe(CO)_s has very low electrical conductivity and this is not increased by the presence of AsCl₃, AcOH, or Ac₂O. Fe(CO)₅ vapour does not react with Al or Zn. Mixed with air Fe(CO)₅ vapour ignites with slight explosion at $\langle 120^\circ$, but O₂ bubbled through liquid Fe(CO)₃ causes spontaneous combustion with detention W. S. with detonation.

Ageing and co-precipitation. XXXVII. Distribution coefficient of arsenate between magnesium ammonium phosphate and solution. I. M. Kolthoff and C. W. Carr (J. Physical Chem., 1943, 47, 148152).—([AsO₄]/[PO₄])_{ilq.} × $(N_{PO_4}/N_{AsO_4})_{solid}$ (N = mol. fraction) = const. = 5.65 ± 0.2 at 25° over the range 1—60 mol.-% AsO₄ in the solid phase. L. J. J.

Co-ordination of silver ion with unsaturated compounds. II. cis- and trans- $\Delta\beta$ -Pentene. III. Mixtures of trimethylethylene and cyclohexene.—See A., 1943, II, 181.

Resolution of enantiomorphs. Liquid-liquid extraction.-See A., 1943, II, 229.

Hysteresis in sorption. K. S. Rao (J. Mysore Univ., 1943, **B. 4**, 39-53).—A review (cf. A., 1941, I, 205). F. R. G.

Adsorption of ions by leached surface films on glass.--See B., 1943, I, 247.

Adsorption in relation to constitution. I. Adsorption of alkaloids by silica gel. B. P. Gyani and P. B. Ganguly (J. Indian Chem. Soc., 1942, 19, 453-460).—The adsorption of morphine, nicotine, quinine, quinidine, cinchonidine, brucine, strychnine, caffeine, and piperine on SiO₂ gel from EtOH solution has been studied at $30-45^\circ$. Equilibrium is reached only after 20-60 days but the adsorption follows the Freundlich equation. Both the amounts adsorbed and their temp. coeffs. are large and alkaloids of similar constitution have comparable adsorption coeffs. The parallelism between the adsorp-tion coeffs. and their poisonous qualities is discussed. J. W. S.

Theory of chromatography. D. DeVault (J. Amer. Chem. Soc., 1943, 65, 532-540).—Single-solute chromatograms are discussed mathematically, ignoring diffusion and non-attainment of equili-brium, and the formation of sharp and diffuse band-edges is explained. If q = f(c) (where q = amount adsorbed and c = concn.) is the adsorption isotherm of the solute, then if f''(c) is >0 the trailing boundary is sharp, but if f''(c) is <0 the leading boundary is sharp. Theoretical vals. for lauric acid on charcoal agree well with the data of Cassidy and Wood (A., 1942, I, 159). Partial differential equations for multiple-solute characterizer beam observables are been obtained and the solute characterizer beam observables. equations for multiple-solute chromatograms have been obtained and the discontinuous solutions of these are discussed. Examination of the two-solute system suggests similarity to the simple systems in boundary formation, but this could not be proved. Diffuse bandedges appear to be more useful than sharp edges for studying the adsorption isotherm of the substance in the band. W. R. A.

Non-ionic surface-active agents.—See B., 1943, II, 205.

Thermodynamics of interfaces in equilibrium. H. T. Yu (J. Chinese Chem. Soc., 1941, 8, 147-151).—A general equation of

equilibrium is given, $\partial \omega d\sigma + \sum_{i=1}^{\infty} [\partial S_i dT - \partial V_i dp_i - \sum_{i=1}^{n} [\partial S_i dT] - \partial V_i dp_i - \sum_{i=1}^{n} [\partial S_i dT] + \sum_{i=1}^{n} [$

 $RT \Sigma \partial M_{ij} d \log_{\sigma} C_{ij} = 0$ where σ is interfacial tension, ω area of

surface, *n* no. of components in the system, S_i , V_i , and P_i entropy, vol., and pressure of the *i*th phase, M_{ij} and C_{ij} quantity in mols. and mol. fraction of the *j*th component in the *i*th phase. It is deduced that the surface tension of a non-volatile liquid is lowered by the presence of an insol. gas. Established formulæ for interfacial phenomena are derived from the new equation. F. R. G.

Energy relations in film penetration. J. Schubert and G. E. Boyd (J. Chem. Physics, 1943, 11, 215).—The surface concn. of Na cetyl sulphate (I) in a cetyl alcohol film on H_2O can be derived thermodynamically by means of the Gibbs equation if the variation of surface tension of the mixed film with (I) is known. L. J. J.

Silica aerogel.-See B., 1943, I, 283.

Mol. wt. and intrinsic viscosities of polyisobutylenes. P. J. Flory (J. Amer. Chem. Soc., 1943, 65, 372-382). $-\pi/c$ ($\pi = \text{osmotic pres-}$ sure, c = concn.) varies non-linearly with c for cyclohexane solutions of polyisobutylenes, the form of the curve being independent of mol. wt. $(\pi/c)_{c=0}$ from these curves can be used to determine mol. wt. up to 1×10^6 . Intrinsic η in dissobutylene solutions obey the relation $[\eta] = kM^{0.64}$ (M = mol. wt.) over the range $M = 5.66 \times 10^3$ to 1.33×10^6 . Deviation from the Standinger equation cannot be ascribed to a non-linear polymer tetructure. ascribed to a non-linear polymer structure. A definition of viscosityaverage mol. wt. is given. W. R. A.

Vapour pressure equation of solutions and the osmotic pressure of rubber, A. R. Miller (Proc. Camb. Phil. Soc., 1943, 39, 131).-Calculations given in a previous paper (A., 1943, I, 126) are corr. A. I. M.

Rubber molecule : its size and significance.-See B., 1943, II, 230.

Sulphonates. VII. Conductances and densities of sodium alkyl-benzene-p-sulphonate solutions. R. G. Paquette, E. C. Lingafelter, and H. V. Tartar (J. Amer. Chem. Soc., 1943, 65, 686-692). Electrical conductances and ρ of solutions of Na ethyl-, n-butyl-, and *n*-octyl-benzene-*p*-sulphonates have been measured at 25°, 40°, and 60°, and of solutions of *p*-*n*-C₁₂H₂₅·C₆H₄·SO₃Na at 60°. C₆H₄ rings are equiv. to $\sim 3\frac{1}{2}$ paraffin-chain C in their effect on the critic control of micello features. crit. concn. for micelle formation. W. R. A.

Electrolytic properties of solutions of paraffin-chain quaternary ammonium salts. A. B. Scott and H. V. Tartar (*J. Amer. Chem.*

Soc., 1943, 65, 692-698).-Conductances of solutions of trimethylbutyl- (I), -hexyl- (II), -octyl-, -decyl- (III), and -dodecyl-ammonium bromides (IV) at 25°, 40°, and 60°, and of $C_{16}H_{33}$ ·Me₃Br at 25° have been measured. All but (I) and (II) form micelles. This was confirmed for (III) and (IV) by measurements of ρ . W. R. A.

Electrolytic properties of trimethyloctylammonium octanesulphon-Lifectrolytic properties of trimethyloctylammonium octanessmin A. B. ate and trimethyldecylammonium decanesulphonate solutions. A. B. Scott, H. V. Tartar, and E. C. Lingafelter (J. Amer. Chem. Soc., 1943, 65, 698—701).—Conductance measurements show that micelles are formed at concus. I than for single paraffin-chain salts, and that the micelles carry approx. unit charge. W. R. A. the micelles carry approx. unit charge.

Osmotic properties of solutions of some typical colloidal electrolytes. J. W. McBain and O. E. A. Bolduan (*J. Physical Chem.*, 1943, 47, 94–103).—F.p. data for H_2O solutions of a no. of dialkyl sulpho-succinic esters ("Aerosols"), K laurate, decoate, and octoate, Na dehydrocholate and deoxycholate, and Tergitol 4 show a concn. range, following the very dil. region in which the KCl curve is followed, in which the f.p. decreases very slightly with a tenfold in-crease in concn. This process ends abruptly with a further concn. range in which the osmotic coeff. has a nearly const. low val.

F.p. of solutions of typical colloidal electrolytes; soaps, sulphon-ates, sulphates, and bile salts. S. A. Johnston and J. W. McBain (Proc. Roy. Soc., 1942, A, 181, 119-133).—Conductivity alone is in many cases an untrustworthy guide to whether or not a par-ticular solution is that of a colloidal electrolyte. Careful f.p. measurements with a no. of colloidal electrolytes show the existence of several different types, although all have in common the replace-ment of ions by colloidal particles with increasing concn. In the family of bile salts the conductivity almost approaches the behaviour of an ordinary electrolyte, but the lowering of f.p. falls off strongly and rather abruptly. It is pointed out that the term "critical concentration" of micelles, as often used, is either an over-simplification or a misconception, the micelle being formed over a wide representation. wide range of concn. G. D. P.

Physical chemistry of resin solutions. VII. Viscosity studies in mixed solvents with some resins and cellulose derivatives. VIII. Viscosity of resins, cellulose derivatives, etc. in mixed solvents. S. R. Palit (*J. Indian Chem. Soc.*, 1942, 19, 414–424, 435–446).—VII. The viscosities of other may in relieve E(0) of relations of other may in relieve E(0) of relations of other may in relieve E(0). The viscosities (η) of solutions of ester gum in xylene-EtOH, glyptal in Bu^aOAc-EtOH, ethylcellulose in *cyclo*hexanol-*cyclo*hexane and EtOH-PhMe, and cellulose nitrate in EtOH-dioxan mixtures have been determined over wide concn. ranges and at 15-30°. With a const. solute concn. the η -solvent composition curves show min. at solvent compositions which are approx. independent of temp. but approach the optimum solvent composition with increasing solute concn.

VIII. It is shown that experimental data are qualitatively in accord with the classical viscosity equations. It is inferred that for const. solute concn. the min. η should occur in solvent containing an excess of the less viscous component as compared with the optimum solvent composition but should approach the latter with increasing solute concn. Corollaries to and tests of this rule are discussed. J. W. S.

Permeability of cellulose fibres. A. Frey-Wyssling and H. Speich (*Helv. Chim. Acta*, 1942, 25, 1474—1484).—Double refraction measurements on ramie fibres after immersion for a day in various liquids indicate that lipoid liquids (hydrocarbons and their halogen derived) the test permette the cell wells be to be back the back of the set of the set of the set of the set of the back of the derivatives) do not permeate the cell walls, but alcohols and aldehydes do so. This behaviour resembles that of starch. With ramie, however, org. bases (NH₂Ph, NHPhMe, quinoline) also penetrate the walls, this behaviour being attributed to the presence of CO₂H groups in the cellulose. Ramie fibres have double refraction and d deficiencies of 4.4 and 12.6%, respectively, as compared with cryst. cellulose. I. W. Š.

Determination of mol. wt. and polydispersity for nitrocellulose fractions by means of the sedimentation equilibrium ultracentrifuge. H. Mosimann (Helv. Chim. Acta, 1943, 26, 369-398).—Results of mol. wt. determinations by means of the sedimentation equilibrium ultracentrifuge are recorded for nitrocellulose fractions (mol. wt. 10,000-80,000). Even carefully fractionated products may have a distribution of particle size with > one max. The Staudinger viscosity law holds as a limiting law over small ranges of mol. wt. F. J. G.

General electrophoretic pattern in extracts of pollens causing hay fever -- See A., 1943, III, 443.

Solubility and electrophoretic studies of serum-globulins. I. γ -Globulin. E. Jameson and C. Alvarez-Tostado (J. Amer. Chem. Soc., 1943, 65, 459-465).—The prep. of homogeneous constituents of γ -globulins is described, using K citrate in place of $(NH_4)_2SO$ which induces heterogeneous mixtures when used in the usual manner as shown by solubility behaviour. Const. solubilities were found for two fractions. Electrophoretic measurements on four fractions and ascertained solubility data are explained in terms of a mobile equilibrium between a complex and its components. W. R. A.

VI.-KINETIC THEORY. THERMODYNAMICS.

Calculation of chemical equilibria in gaseous systems by the aid of the Nernst equations or from entropies; application to various equilibria, especially that of nitric orde. E. Briner (*Helc. Chim.* Acts, 1942, 25, 1515—1527).—Equilibrium data for the systems $2NO \rightleftharpoons N_2 + O_2$, $CO + H_2O \rightleftharpoons CO_1 + H_2$, $N_2 + 3H_4 \rightleftharpoons 2NH_2$, and $2O_3 \rightleftharpoons 3O_2$ as calc. from the Nernst equations, are in satisfactory agreement with the vals. calc. from entropy data and with experimentally determined vals. It is suggested, therefore, that the approx. equation can be used satisfactorly for calculating these data by Nernst's method, especially when entropy data are lacking.

by Nernst's method, especially when entropy data are lacking. J. W. S. Vapour pressures of halogen acids. S. P. Walvekar, N. L. Phalnikar, and B. V. Bhide (J. Univ. Bombay, 1943, 11, A. Part 5, 69-76).—Lowering of the v.p. of HCl in CCl₄ and in m-C₆H₁₄, and of HBr in CCl₄, by addition of PhOMe may be due to formation of [PhOMe]'X', although the equilibrium coasts. $K = C_{comptr}/[C_{tow HCl} X_{comptr}]$ for C₆H₄R-OMe (R = H, p-Cl, -NO₂, -OMe) exhibit no relationship to the velocity coeffs. of their hydrolysis. No lowering occurred in C₆H₆. F. R. G.

Quantitative investigations of amino-acids and peptides. XIII. Equilibria between histidine and formaldehyde. XIV. Equilibria between amino-acids and formaldehyde : arginine and lysine. E. H. Frieden, M. S. Dunn, and C. D. Coryell (J. Physical Chem., 1943, 47, 85—94, 118—133; cf. A., 1943, I, 181).—XIII. Polarimetric titrations give vals. 0.74, 6.6 \times 10³, 1.68 \times 10³, 4.2 \times 10⁴, 1.45 \times 10⁵ for the equilibrium consts. L_{11} , L_{12} , L_{22} , L_{14} , and L_{22} (using Levy's terminology), respectively, for the reaction between histidine and CH₂O. Each of the three ionic forms of histidine reacts with 2 successive CH₂O mols.

XIV. l(+)-Arginine and CH₂O react by an instantaneous and probably reversible combination of 1 mol. of each, followed by slow irreversible combination of the product, involving the guanidinogroup, with a further CH₂O. l(+)-Lysine shows two main equilibria followed by complex formation, with equilibrium consts. differing from those found by Levy (cf. A., 1935, 703). L. J. J.

Association of boron trifluoride additive compounds with amines in non-polar solvents. J. R. Bright and W. C. Fernelius (J. Amer. Chem. Soc., 1943, 65, 735-736).—Mol. wt. determinations on NMe, BF, and NPhMe, BF, indicate association. Vals. of the association consts. for equilibria between mono- and di-, monoand tri-, and mono- and tetra-merides are in no case consistent with the assumption that each of these equilibria is independent of the others. W. R. A.

Two protons in one step. G. Schwarzenbach and R. Sulzberger *(Hels. Chim. Acta*, 1943, 26, 453—459).—The structural conditions for a diprotonic acid to have $K_1 \gg K_1$ are discussed. They are fulfilled by the cation

fulfilled by the cation [p-OH-C,H, NH:CH-CH:CH-CH:CH-NH-C,H, OH-p], which has $pK_1 = 8.75$ and $pK_2 = 8.25$ at 20° and ionic strength = 0.2.

F. J. G. Effect of substituents on acid strength of benzoic acid. VI. Cyanogroup. M. Kilpatrick and R. D. Eanes (J. Amer. Chem. Soc., 1943, 65 539-590).—Relative acid strengths of m- and p-CN-C, H, -CO, H have been determined in H₂O, (CH₂-OH)₂, MeOH, EtOH, and dioxan-H₂O mixtures at 25°, in all of which the p-acid is the stronger. W. R. A.

Approximate estimation of the isoelectric point of soluble proteins. -See A., 1943, III, 517.

Ionisation constants of substituted phenylarsonic acids. D. Pressman and D. H. Brown (J. Amer. Chem. Soc., 1943, 65, 540-543).— First and second ionisation consts. of 19 substituted phenylarsonic acids in H_2O at 22^s are given. Substituents change the first and second const. by the same factor. *m*- and *p*-substituents introduce effects similar to those in BzOH, and *o*-substituents to those in BPh(OH)₂. W. R. A.

High mol. wt. aliphatic amines and their salts. X. Ionisation constants of primary and symmetrical secondary amines in aqueous solution. C. W. Hoerr, M. R. McCorkle, and A. W. Ralston (J.*Amer. Chem. Soc.*, 1943, 65, 328—329).—Ionisation consts. for the *x*-primary aliphatic amines containing 4—18 C, isobutyl-, isoamyl-, and docosyl-amines, and symmetrical normal sec. aliphatic amines (with 6, 8, 12, 13, 15, and 18 C in chain) have been calc. from measurements of Λ . W. R. A.

Bearing of the dissociation constant of urea on its constitution. J. Bell, W. A. Gillespie, and D. B. Taylor (*Trans. Faraday Soc.*, 1943, 39, 137-140).—The basic dissociation const. of $CO(NH_4)_3$, remeasured, is $\sim 1.47 \times 10^{-14}$ at 21°; acidic dissociation is undetectable. A zwitterion structure is not compatible with these results, and an explanation of the monobasicity of $CO(NH_4)_3$, and the low val. of its dissociation const. by means of a resonance hybrid is suggested. F. L. U.

Stability of racemates. Mandelic acid and its derivatives.--See A., 1943, II, 229.

Temperature-concentration equilibria in the system dimethylaniline-sulphur dioxide. J. R. Bright and W. C. Fernelius $(J_{\cdot}, Amer. Chem. Soc., 1943, 65, 637-639)$.—The m.p. curve for NPhMe₂-SO₂ shows two cutectics and a max. corresponding with the compound NPhMe₂, SO₂ (I). (I) has m.p. 12°, d_4^{27} 1-08, and separates as a red oil on adding light petroleum to the mixture. It is associated in NPhMe₂. W. R. A.

Phase behaviour of lithium palmitate with water and with lithium chloride and water. M. J. Vold (J. Amer. Chem. Soc., 1943, 65, 465–469).—The Li palmitate-H₄O system has been studied and compared with the Na palmitate-H₄O system. At high soap concns. the binding power of H₄O in superneat soaps and the H₄O in soap of max. thermal stability follow the order Li > Na > K. Li palmitate-LiCl-H₄O systems are described containing up to 2% LiCl, which increases the stability of the more solid phases. W. R. A.

Determination of equilibrium diagrams by X-ray methods. I. Determination of phase boundaries in equilibrium diagrams by X-ray methods. E. A. Owen. II. Application of X-ray methods to determination of phase boundaries in metallurgical equilibrium diagrams. W. Hume-Rothery. III. Examination of heat-treated alloys by X-rays and by the microscope. A. J. Bradley. IV. Metallurgist's point of view. M. L. V. Gayler. V. Discussion (J. Inst. Metals, 1943, 69, 2-8, 8-12, 12-15, 15-17, 18-27).-A Discussion of the advantages and limitations of X-rays and of the relative val. of this method and the microscope in the determination of equilibrium diagrams. A. R. P.

Liquid-liquid phase equilibria of the system cyclohexane-methyl alcohol in presence of various salts as third components. E. L. Eckfeldt and W. W. Lucasse (*J. Physical Chem.*, 1943, **47**, 164--183).—A phase curve for the system has been obtained. The crit. solution temp. is $45\cdot14^\circ$. The effects of NaCl, NaBr, NaI, NaNO₃, and NaCNS at various concns. up to saturation have been determined. The anionic lyotropic order is $I' > CNS' > Br > Cl' > NO_3'$.

Lyotropic order and effects of sodium salts on miscibility of cyclohexane and methyl alcohol. E. L. Eckfeldt and W. W. Lucasse (J. Physical Chem., 1943, 47, 183—189; cf. preceding abstract).— Salting-out action on the reverse order effect found with cyclohexane-MeOH depends on the net result of competing electrostatic effect, compound formation, and ionic polarisation. L. J. J.

Effect of temperature on liquid-liquid equilibrium. Benzeneacetone-water system and docosane-a_d-diphenylherane-furfuraldehyde system. S. W. Briggs and E. W. Comings (Ind. Eng. Chem., 1943, 35, 411—417).—The phase equilibria of both systems have been investigated over a range of temp. Binodal curves representing the boundary between uni- and di-phase regions and tie lines have been constructed at 15°, 30°, and 45°. Temp. affects the two systems differently. For C₄H₄-COMe₄-H₂O it alters the slope of the tie-lines but changes solubility only slightly; in the other system it hardly affects tie-line slope but brings about a decided change in solubility. The effect of temp. on the no. of stages required for given separations is discussed. C. R. H.

Ternary and binary vapour-liquid systems. Method of tie-line interpretation for phase equilibrium relations. C. E. Dryden (Ind. Eng. Chem., 1943, 35, 492-494).—A method of correlating equilibrium distribution relations of the solute between conjugate phases on a solvent-free basis in liquid-liquid and vapour-liquid systems and its applications to the graphical solution of the Maloney-Schubert diagram (cf. B., 1941, I, 47) for theoretical extraction stages are presented. C. R. H.

Equilibrium in the hydrogen-methane-steel system. C. F. Gray (Iowa State Coll. J. Sci., 1942, 17, 66-68).—The equilibrium between H₂, CH₄, and the Fe₃C in steel has been studied at 750-900° and the equilibrium const. calc. from the relation $K = N_{Fe_3C} \times N_{Ga_3} \times P/(N_{Fa_3} \times N_{Ga_4})$, where N_{H_3} and N_{CH_4} refer to mol. fractions in the gas phase and N_{Fe_3C} and N_{Fe} to mol. fractions in the solid. From the results the heat of the reaction 3Fe (γ) (in austenite) + CH₄ = Fe₃C (β) (in austenite) + 2H₄ is calc. to be 23,500 g.-cal. at 850°. Combining this result with heat capacity and transition data, the heat of the reaction 3Fe (α) + CH₄ \rightleftharpoons Fe₃C (α) + 2H₂ is calc. to be 14,700 g.-cal. at 25°. J. W. S.

Merwinite in the system CaO-MgO-SiO₂.-See A., 1943, I, 188.

Ternary system CaO-P.O. SiO. -- See B., 1943, I, 291.

Heats of dilution of aqueous solutions of glycine at 25°. W. E. Wallace, W. F. Offutt, and A. L. Robinson (J. Amer. Chem. Soc., 1943, 65, 347-350).—Heats of dilution of aq. glycine (0.8-0-0003M.) have been measured at 25° and partial molal heat contents have been calc. The behaviour in very dil. solutions conforms more closely to the theory of Fuoss than do previously existent data.

W. R. A. Entropy of hydration of gaseous ions. F. H. Lee and Y. K. Tai (J. Chinese Chem. Soc., 1941, 8, 184–193).—The theoretical entropy of hydration is calc. to be $\Delta S = -6\cdot 4 - k(1-1/n)r$, where k is

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19.5 for univalent and 58.5 for bivalent ions, r is the ionic radius, and n is the repulsion exponent (cf. Pauling, A., 1927, 399), in good agreement with experimental vals. F. R. G.

Heat of hydration of gaseous ions. F. H. Lee and Y. K. Tai (J. Chinese Chem. Soc., 1942, 9, 41-45; cf. preceding abstract).—The authors' theory by which the entropy of hydration of gaseous ions was expressed as a function of ionic radii has been extended to cover the heats of hydration of gaseous ions. The results accord with experimental data for alkali and alkaline-earth metal ions.

J. W. S. Thermodynamic properties of air at low temperatures.—See B., 1943, I, 264.

Thermodynamics of aqueous potassium bromide at 25° from e.m.f. measurements on cells with transference. E. A. MacWilliam and A. R. Gordon (*J. Amer. Chem. Soc.*, 1943, **65**, 984—985).—E.m.f. of the cell with transference Ag,AgBr|KBr(m_1)|KBr(m_2)|AgBr,Ag has been measured at 25° for conces. up to 0·1M. Calc. vals. for activity and osmotic coeffs. at various conces. agree well with those obtained by other methods. W. R. A.

VII.—ELECTROCHEMISTRY.

Conductance of aqueous solutions of magnesium perchlorate. P. van Rysselberghe and J. M. McGee (J. Amer. Chem. Soc., 1943, 65, 737–738).—Vals. for A^{25^*} for aq. $Mg(ClO_4)_2$ from 0-001 to 6.588 equiv. per l. are given. $A_0^{25^*}$ is 128.5 mho. W. R. A.

Transference numbers of potassium bromide in aqueous solution at 25°. A. G. Keenan and A. R. Gordon (*J. Chem. Physics*, 1943, 11, 172—174).—Data for 25° and [KBr] up to 0·1N., obtained with autogenic cation boundaries with CdBr₂ as indicator, sheared anion boundaries with KIO₃ as indicator, and falling cation boundaries with LiBr as indicator, are recorded. L. J. J.

Single potential difference at a cadmium electrode. J. A. Chalmers (*Phil. Mag.*, 1942, [vii], **34**, 349–353).—The scraped electrode method indicates that the "null" solution for a Cd electrode in CdSO₄ is ~ $1.5_{\rm N}$. The single electrode potential of Cd is ~-0.005 v. A. J. M.

Contact potentials. J. A. Chalmers and W. Hume-Rothery (Phil. Mag., 1943, [vii], 34, 213).—A correction (cf. A., 1942, I, 268). A. J. E. W.

Effect of addition of salts on hydrogen overvoltage. G. A. Eaton (*Iowa State Coll. J. Sci.*, 1942, 17, 54—56).—The H-overvoltage (η) of Fe in 0.02—2N-NaOH decreases with increasing [NaOH], especially at high c.d. Except at very low c.d. (0·1 ma. per 2·25 sq. cm.) where a consistent increase in η is observed with increasing additions of Na₂SO₄, η in NaOH-Na₂SO₄ solutions passes through a max. when [NaOH] = [Na₂SO₄]. In aq. KOH η is < in aq. NaOH, whilst in aq. Ba(OH)₂ η is higher at low c.d. and lower at high c.d. than in KOH or NaOH. In Ba(OH)₂-BaCl₂ solutions η is > in NaOH-NaCl or KOH-KCl solutions, when the solutions are 2N. in the chlorides and 0·2N. in the hydroxides, whilst it is still greater in NaOH-NaCl than in KOH-KCl. In 2N-NaOH η is decreased by the addition of NaAlO₂ or Na₂SiO₃ but is increased by the addition of Na₃PO₄ or NaCl. The interpretation of these results is discussed. I. W. S.

Deviations between observed and calculated polarographic diffusion currents. W. M. MacNevin and E. W. Balis (*J. Amer. Chem. Soc.*, 1943, **65**, 660—665).—Diffusion currents of Cd^{**}, Zn^{**}, Cu^{**}, Pb^{**}, I^{*}, and Fe(CN)₆^{**'} in 0.1M-NO₃' solutions have been measured polarographically. Deviations from the Ilkovič equation are due, not to complex ion formation, reaction with Hg, or irregularities in drop-formation, but to stirring effects. Departures from theory were observed when photomicrographic examination showed that the cathode drops were spherical and that secondary remaining drops produced a negligible effect, as Ilkovič assumed. Effects of mechanical agitation by N₂ bubbles and of varying cathode dropping rates on the deviations have been determined. W. R. A.

VIII.—REACTIONS.

Unimolecular reactions. D. D. Eley (*Trans. Faraday Soc.*, 1943, **39**, 168—172).—The conditions under which the "square-term" and "transition-state" formulæ are applicable to unimol. reactions are discussed. For the special case of "fast" reactions an experimental criterion is described whereby it may be ascertained which is the rate-determining step, and consequently which formula is appropriate. A particular limitation of the "square-term" formula is pointed out. F. L. U.

Thermal decomposition of hydrocarbons, resonance stabilisation, and isomerisation of free radicals. A. Kossiakoff and F. O. Rice (J. Amer. Chem. Soc., 1943, 65, 590-595).—Free radicals formed in the thermal decomp. of paraffins are stabilised by resonance, which is least in primary and greatest in *tert*. radicals. Resonance accounts for differing rates of removal of primary, sec., and tert. H atoms from hydrocarbons by free radicals. Long-chain radicals may isomerise internally, e.g., n- to isohexyl. These factors are considered in calculating the proportions of products from hexanes, heptanes, and octanes, giving improved agreement with experimental data. W. R. A.

Kinetics of polymerisation reactions. I. First-order initiation reaction. II. Second- and combined second- and first-order initiation reactions. Mutual stabilisation of growing chains. R. Ginell and R. Simha (J. Amer. Chem. Soc., 1943, 65, 706-715, 715-727). —I. A mathematical theory of polymerisation, involving the rate of formation of nuclei, their rate of growth, and the rate of cessation of growth, is developed. The relation between the final average chain length and chain length distribution and the rate coeffs. and initial concn. is discussed when the rate of cessation to rate of initiation and rate of propagation to rate of cessation of growth are (a) large and (b) small. For (a) the average mol. wt. is large and approx. const. in the last stages whilst for (b) the average mol. wt. increases continuously, reaching a final small val. Reaction rate coeffs. can be determined.

II. When initiation is second order the final average mol. wt. is smaller, approaching the previous vals. if the rate of initiation becomes very small. Final average chain length does not depend on initial concn. Mutual cessation of growth of chains, and its effect on final average mol. wts. and chain length distribution, are considered. W. R. A.

Kinetics of hypoiodite decomposition. C. H. Li and (Miss) C. F. White (J. Amer. Chem. Soc., 1943, 65, 335–339).—Hypoiodite was determined by its rapid reaction with tyrosine. In strongly alkaline solution the rate law at 25° is $-d[OI']/dt = 2.9[OI'] + 104[OI']^2[I']/[OH']$. Heat of activation for the second path, calc. from the rate laws at 25° and 2° , is 12.4 kg.-cal. Mechanisms for each path are proposed. W. R. A.

Kinetics of exchange reactions of the type $RI + I^* \rightleftharpoons RI^* + I'$ in alcoholic solution. H. A. C. McKay (J. Amer. Chem. Soc., 1943, 65, 702—706).—Reaction of alkyl iodides with radio-I ion in EtOH is bimol. Velocity and temp. coeffs. and energies of activation have been determined. Variation of bimol. velocity coeff. with concn. of reactants has been studied for EtI at 30°. W. R. A.

Deuterium exchange in the system hydrogen deuteride-methyl alcohol. A. G. Gassman, C. J. Hochanadel, and R. J. Hartman (J. Amer. Chem. Soc., 1943, 65, 988).—Velocity coeffs. of the esterification, catalysed by DCl, of 9 aromatic acids have been determined, Identity with vals. of the HCl-catalysed reaction is adduced as evidence for D exchange. W. R. A.

Action of free radicals on para-hydrogen. III. Dipyridinium radicals. G. M. Schwab, E. Schwab-Agallidis, and N. Agliardi (*Ber.*, 1940, **73**, [*B*], 279—285).—Measurement of the p-H transformation in MeOH combined with measurements by other authors in different solvents shows that the mol. rate of transformation in valency-saturated liquids is additively composed of a const. contribution of induced magnetic moments and a contribution of the nucleus moments of each proton. Towards p-H 1: 1'-dibenzyl-4: 4'-dipyridinium is not a diradical and its monochloride is a completely dissociated monoradical. H. W.

Hydrolysis. II. Comparison of the saponification constants of the phenyl esters of fatty acids with those of their cyclohexyl esters. B. E. Mirza and G. D. Advani (J. Univ. Bombay, 1943, 11. A. Part 5, 63-68; cf. A., 1942, I, 243).—Velocity coeffs. are recorded for the saponification by EtOH-KOH of Ph and cyclohexyl esters of AcOH, EtCO₂H, and Pr^aCO₂H and of cyclohexyl isobutyrate. For a given acid, the coeff. for the cyclohexyl is ~28 times that of the Ph ester. F. R. G.

Kinetics of phloroglucinolcarboxylic acid. E. Baur and P. Giger (*Helv. Chim. Acta*, 1943, **26**, 450–453).—The work of Widmer (A., 1920, 517) has been repeated and confirmed. The plot of reaction rate against distance from equilibrium in the neighbourhood of the equilibrium point forms two straight lines intersecting sharply at the origin. F. J. G.

Kinetics of hæmoglobin reactions. D. D. Eley (*Trans. Faraday* Soc., 1943, **39**, 172–181).—The data of Hartridge and Roughton (cf. A., 1923, 229, 746; 1925, 557; 1934, 1073; 1937, III, 2) are discussed from the point of view of transition-state theory, and vals. of the energy and entropy of activation are calc. for the reactions of hæmoglobin with O_2 and with CO in aq. solution. By the standards of chemical kinetics the reaction with CO appears to be fairly normal, whilst that with O_2 is not, the difference between the activation energies of the forward and back reactions differing greatly from the heat of reaction. The association reactions are characterised by their low activation energy, and the dissociation by its high entropy of activation. It is suggested that this may be due to loosening of the structure of the protein on forming an activated complex. The activated complexes are probably different for the forward and back reactions. F L. U. Resolution and rates of hydrolysis of *dl-a*-bromopropionic acid and its glycine derivatives.—See A., 1943, II, 215.

Inversion of *l*-menthone and reaction of diazoacetic ester with chloroacetic acids. Inversion of menthone with trichloroacetic acid in aprotic solvents. Influence of addenda on inversion of *l*-menthone with acids in benzene.—See A., 1943, II, 202.

Disappearance of thiosulphate in solutions of maleic acid ; catalysis of cis-trans-isomerisation. H. Taube (*J. Amer. Chem. Soc.*, 1943, 65, 526—531).—Disappearance of S_2O_3'' in maleic acid (I) solutions proceeds by two paths, the importance of each path depending on the acidity. Two paths are also observed in the formation of fumaric acid in solutions of (I) and S_2O_3'' , similar in nature to the corresponding paths for S_2O_3'' decomp. Catalysis of the cis-trans isomerisation by the reaction of H_2S and SO_2 was examined. W. R. A.

Effects of inorganic electrolytes on the liberation of -SH in proteins. N. F. Burk (*J. Physical Chem.*, 1943, 47, 104—118).—Many electrolytes inhibit liberation of titratable 'SH in solutions of ovalbumin (**I**), edestin (**II**), and lactalbumin (**III**), denatured by $CO(NH_2)_2$ or $CaCl_2$. Inhibition increases in the order of the Hofmeister series. A lyotropic series Mg'' < Mn'' < Ba'' < Ca'' is found for denaturation of (**II**). $MgCl_2$ and $MnCl_2$ inhibit liberation of 'SH at high, but produce it at low, concns., whilst their sulphates and acetates inhibit at all concns. Opposite effects on (**I**) and (**III**) are found with HCl and $MgCl_2$. Denaturation of (**III**) by CaCl₂ is inhibited by cations in the order Na' < K' < NH₄' < Mg'' < H', and is also produced by Ca(OAc)₂.

Decomposition of ethylene and carbon monoxide on metallic catalysts. A. R. McKinney (*J. Physical Chem.*, 1943, 47, 152— 163).—Of the metals Co, Cu, Fe, Ni, Os, Pd, Pt, Zn, prepared under uniform conditions, only those which form carbonyls catalyse decomp. of CO. Decomp. of C_2H_4 is related to at. radius. L. J. J.

Catalytic decomposition of ethyl alcohol in presence of magnesium oxide. T. T. Castonguay (*Iowa State Coll. J. Sci.*, 1942, 17, 37–39).—The products of the decomp. of EtOH vapour on MgO at $365-457^{\circ}/1$ atm. include MeCHO, PreCHO, COMePre, BueOH, COMe₂, and (CH₂:CH)₂. The decomp. under pressure in the presence of MgO at $394-497^{\circ}$ yields a complex mixture of products. J. W. S.

Surface area and catalytic activity of zinc oxide pigments. C. W. Siller (J. Amer. Chem. Soc., 1943, 65, 431-434).—Prep. of ZnO pigments with different sp. surfaces, but the same surface characteristics, is described. Catalytic activity per g. for the decomp. of MeOH α the sp. surface measured microscopically. W. R. A.

Application of palladium- and platinum-polyvinyl alcoholvanadium catalysts. L. D. Rampino and F. F. Nord (J. Amer. Chem. Soc., 1943, 65, 429-431).—Reduction of PhCHO, cinnamaldehyde, maleic acid, benzoquinone, and I is described. Vanadous catalysts with O_2 -free H_2 establish the dispensability of O_2 in noble metal reductions. W. R. A.

Catalytic activity of activated nitrogenous carbons. P. F. Bente and J. H. Walton (*J. Physical Chem.*, 1943, **47**, 133—148).—A no. of nitrogenous C and one sugar C sample showed optimum activation at 875° for effect on (i) decomp. of H_2O_2 , (ii) oxidation of quinol, and (iii) oxidation of K urate, with activity decreasing in the same order for each reaction. C from $(CH_2)_6N_4$ has a very high activity. Adsorption of O_2 produces decay for reactions (i) and (iii) only, and 0.001n-KCN inhibits the action of nitrogenous C, but not of sugar C. I adsorption α surface area, but is not correlated with the (small) active surface. L. J. J.

Oxidation of resorcinol by hydrogen peroxide in presence of tungstic acid sol as catalyst.—See A., 1943, II, 217.

Electrolysis of manganous sulphate and sulphuric acid. D. N. Solanki and M. Prabhanjanmurty (J. Indian Chem. Soc., 1942, 19, 473-480).—A detailed study of the electrolysis of MnSO₄ and H₂SO₄ under various conditions has been made in order to find the optimal yields of oxidation products. The ranges over which the conditions were varied are followed by the optimum vals. in the list below : $[H_2SO_4]$ 30-90%, 60%; $[MnSO_4]$ $1\cdot5-9\%$, $7\cdot5\%$; temp. $15-80^\circ$, 60° ; inter-electrode distance, 2-9 cm., $5\cdot5$ cm.; anodic c.d., 100-480, 300 amp. per dm.²; cathodic c.d., 52-750, 270 amp. per dm.²; current concn., $0\cdot0105-0\cdot025$, $0\cdot019$ amp. per c.c. The nature of the anodic material affects the results considerably. With a graphite anode there was no oxidation. The effect of 18 catalysts was studied. Ce(SO₄)₂, KIO₃, CoSO₄, Pb(OAc)₂, and HF considerably improved the current efficiency for anodic oxidation. Tl₂(SO₄)₃, KI, and HCl were negative catalysts. An explanation of the catalytic effect is offered. If a.c. is superimposed on the d.c. electrolysing current, the current efficiency improves greatly. The latter, however, is decreased by passing steam through the electrolyte.

A. J. M. [Electrolytic] surface protection of magnesium alloys.—See B., 1943, I, 301. Photochemistry of the formation of sulphuryl chloride. M. C. Londergan (Iowa State Coll. J. Sci., 1942, 17, 95–97).—The photochemical reaction between SO₂ and Cl₂ has been studied at 70° and initial pressures 12–60 mm. With 4358 A. radiation the quantum efficiency is $1\cdot 2\pm 0\cdot 2$. This is interpreted as indicating that it is possible for the excited Cl₂ mol. to combine directly with a SO₂ mol. The equilibrium const. of the dissociation of SO₂Cl₂ has been studied in the presence of animal charcoal at 70–100° and the heat of dissociation ΔH_0 calc. as 12,795 g.-cal. per g.-mol. An expression for the free energy of dissociation of SO₂Cl₂ at any temp. is also given. J. W. S.

Inhibitory effect of iodine on the photolysis of gaseous hydrogen iodide. R. A. Ogg, jun., and R. R. Williams, jun. (*J. Chem. Physics*, 1943, 11, 214-215).—The ratio of the rate coeffs. k_2/k_1 for the reactions $H + HI \rightarrow H_2 + I$ (i), $H + I_2 \rightarrow HI + I$ (ii) in $HI - I_2$ mixtures with [HI] 50-150 mm. and [I_2] 0-20 mm. Hg at 108° is 4.9 ±0.3, independent of temp. over ~50° range. Reaction (ii) must have a small finite activation energy. L. J. J.

Latent image formation.--See B., 1943, II, 234.

Photochemical reactions between vinyl chloride and chlorine or bromine, leading to the formation of $a\alpha\beta$ -trichloroethane and $a\beta$ -dibromochloroethane. R. Schmitz and H. Schumacher (Z. physikal. Chem., 1942, **B**, 52, 72—89).—The photochemical chlorination of CH₂:CHCl (I), affording CH₂Cl-CHCl₂ (II), at a pressure of (I) > \sim 70—100 mm.; accords with $+d[(II)]/dt = k[I_{abc.}]^{\frac{1}{2}}[Cl_2]$. The quantum yield is high (\sim 10⁵) and the temp. coeff. only very slightly >1. O₂ strongly inhibits the reaction. The photo-chemical bromination of (I), affording CH₂Br-CHClBr (III) accords with $+d[(III)]/dt = k[Br_2][I_{abc.}]^{\frac{1}{2}}([I])^{\frac{1}{2}}$. The quantum yield is \sim 10⁵, and the temp. coeff. 0.85 for 10°. O₂ strongly inhibits the reaction. Mechanisms for both reactions are proposed. F. J. G.

Intermediate step in the autoxidation of quinol. Aerial fogging of photographic emulsions. T. H. James (J. Chem. Physics, 1943, 11, 183–187).—Neither chemiluminescence nor H_2O_2 can account for aerial fog during oxidation of quinol in presence of photographic emulsions, since the former is undetectable during aerial fogging, and very large $[H_2O_2]$ is required to produce a comparable effect. A transitory radical, probably HO_2' or O_2' , is suggested as the fogging agent. L. J. J.

Photo-oxidation of quinine. T. L. Rama Char (J. Indian Chem. Soc., 1942, 19, 447—452).—The photochemical oxidation of quinine hydrochloride by $UO_2(NO_3)_2$, $NaVO_3$, and $K_2Cr_2O_7$ has been studied, the sols produced in the presence of the last two reagents being peptised. In the oxidation by $UO_2(NO_3)_2$ the velocity of reaction $v \propto$ the intensity of light absorbed (I) whilst in the reaction with $NaVO_3$ and $K_2Cr_2O_7 v \propto I \times [sol]$. For the reaction with $NaVO_3$ in *l*-circularly polarised light v is > for the reaction in *d*-circularly polarised light, as predicted from the circular dichroism exhibited by the sols in the ultra-violet spectral region. J. W. S.

Photo-oxidation of chlorophyll. S. Aronoff and G. Mackinney (J. Amer. Chem. Soc., 1943, **65**, 956–958).—Photo-oxidation of chlorophyll a and b, and the retardation by carotene (I), have been studied kinetically. Oxidation is probably second order and has a low quantum efficiency. Protective action becomes const. in solutions containing > 1 mol. of (I) to 8 mols. of chlorophyll. W. R. A.

Chemical processes involving radio-bromine. Behaviour of ethyl bromide on radio-activation in the gas phase and the reaction between the active bromine atoms produced and acetylene. H. Suess (Z. physikal. Chem., 1940, **B**, 45, 297–311).—Mixtures of EtBr vapour and HBr and DBr, with and without C_2H_2 , were activated by neutrons and, by analysing the H₂O-sol. and org. portions of the system, the fate of Br* has been determined. With C_2H_2 absent, Br* is found as HBr*, indicating ejection of Br* from EtBr. When C_2H_2 is present, org. Br* compounds are formed, the amount depending on the partial pressure of C_2H_2 and increasing on replacement of HBr by DBr. That unchanged Br* atoms are produced has been proved by activation experiments in electric fields. Rate of addition of Br* to C_2H_2 is \gg the rate of exchange with HBr. Br* does not perceptibly react with H. W. R. A.

Behaviour of hydrogen bromide in nuclear processes of bromine. H. Suess (Z. physikal. Chem., 1940, **B**, 45, 312—322).—When EtBr is bombarded by neutrons in the presence of HBr and C_2H_6 , radio-Br is produced by four processes: (1) capture of neutron by EtBr; (2) capture of neutron by HBr or DBr; (3) transition of $H^{80}Br^*$ (4.5 hr.) into $H^{80}Br$ (18 min.); (4) photochemical formation of g^*Br . (1) involves rupture of the mol. binding of Br; in (2) the emitted γ -quanta are usually not great enough to rupture the mol. binding; whilst in (3) excited HBr is formed. W. R. A.

Decomposition of potassium iodide by ultrasonic waves. J. N. Bhar (J. Counc. Sci. Ind. Res., India, 1943, 1, 106–108).—Supersonic waves (ν not stated) cause partial decomp. of KI solutions to give free I, the % decomp. decreasing (14.7–0.13%) with increasing concn. (0.006–0.4N.). >90% of the I from 0.5N-KI was recovered

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by repeated (18 times) removal of I on activated C followed by re-exposure of the solution. M. H. M. A.

IX.—PREPARATION OF INORGANIC SUBSTANCES.

"Inorganic benzene," $B_3N_3H_6$. E. Wiberg and A. Bolz (*Ber.*, 1940, 73, [B], 209–232).—At room temp. B_2H_6 and NH_3 give the com-pound, B_2H_6 ,2NH₃, independent of the excess of NH_3 . At higher temp. with a large excess of NH_3 the product is $B_2(NH)_3$ and thence BN. *Borazene* (I), $B_3N_3H_6$, b.p. 55.0°, m.p. -58.0° (many other physical data recorded), is best obtained from B_2H_6 and NH_3 (mol. ratio 1:2) at >200°/l atm. Its constitution, BH NH+BH NH,

follows in that it gives 2 Me derivatives one of which is hydrolysed to $B(OH)_3$, NH_2Me , and H_2 whilst the other yields NH_3 and $BMe(OH)_2$. The fine structure shows a very close relationship to that of C_8H_8 . The mode of formation is discussed. (I) is more reactive than C_8H_8 . At room temp, and in absence of catalyst it adds 3 mols. of compounds HX (X = Cl, Br, OH, OMe), giving derivatives (II) of "inorg. cyclohexane." NH_3 is added slowly and in a complex manner. At 50—100° (II) evolve 3 H_2 and give the "aromatic system" so that the ultimate effect is a substitution in (I) arbus (I) and HBr at 100° afford B N H Br. alternatively the afoint system so that the intrinsic methods in (I). Thus (I) and HB at 100° afford $B_3N_3H_3Br_3$; alternatively, the re-formed "aromatic ring" may disrupt into three similar components. If (II) are heated in presence of HX, HX adds to the double linkings formed by loss of H_2 from (I), the end effect therefore being substitution of H by X with evolution of H_2 from the cyclohexane mol. Attempted hydrogenation of (I) in presence of finely-divided No. Attempted hydrogenation of (1) in presence of hiely-divided Ni at 190° causes fission of the ring and production of compounds of high mol. wt.; similar condensation occurs in presence of Pd at 50°. With excess of Br at 0° (I) affords a yellow additive product which evolves HBr at room temp. or more rapidly at $60-70^\circ$, giving the *compound*, $B_3N_3H_2Br_4$ ("inorg. dibromobenzene"), which is readily hydrolysed to "inorg. resorcinol." H. W.

Magnesium carbides. W. H. C. Rueggeberg (J. Amer. Chem. Soc., 1943, 65, 602-607).-MgC₂ is unstable at high temp., yielding free C and Mg_2C_3 . Mg_2C_3 is shown, by a variety of tests, to be a pure substance and appears to contain a 3-C chain in its crystal lattice. MgC_2 (prep. from $MgEt_2$ and C_2H_2) has been examined by the X-ray powder method; the data compare well with those for the tetragonal CaC₂ structure having a_0 4.86, c_0 5.76 A. An explan-ation of the reactivity and instability of MgC_2 is advanced. W. R. A. W. R. A.

Red zinc oxide. W. Ehret and A. Greenstone (J. Amer. Chem. Soc., 1943, 65, 872-877).—Red ZnO can be prepared by heating white ZnO with NH₄ salts or CO(NH₂)₂ or NH₂Ac but the most suitable method is to heat white ZnO with NH₄NO₃. The red oxide contains $\sim 0.02\%$ of Zn in excess and its colour val. is the higher the higher is the amount of excess Zn. The average particle size in the red oxide is > in the solute but vals. of ρ and solubility are identical. The cause of coloration cannot be unequivocally stated but the presence of F centres is favoured. Ŵ. R. A.

Fractionation of the rare earths by zeolite action. R. G. Russell and D. W. Pearce (*J. Amer. Chem. Soc.*, 1943, **65**, 595-600).— Fractional separation of rare earths by zeolites has been effected. Rare earth ions of decreasing ionic radius are held more firmly in the zeolite lattice than larger ions. Removal of rare earth ions from the zeolite may be carried out fractionally, the largest ions being removed first. w R. A.

Hydrate isomerism in the hydrated chromic chlorides. Preparation of of triethylenediaminechromic chloride from hexa-aquochromic chloride. L. E. Marchi and J. P. McReynolds (*J. Amer. Chem. Soc.*, 1943, **65**, 480–481).—[Cr(en)₃]Cl₃, in yields $\geq 25^{\circ}_{.6}$ of theoreti-cal yield, was prepared by action of dry (CH₂·NH₂)₂ on [Cr(H₂O)₆]Cl₃ but not on [Cr(H₂O)₄Cl₂]Cl₂H₂O or [Cr(H₂O)₅Cl]Cl₂, H₂O. W R A

W. R. A.

Reactions of nickelous, nickelonickelic, and ferric oxides in liquid ammonia. R. B. Holt and G. W. Watt (J. Amer. Chem. Soc., 1943, 1943). 65, 988-989).-All are insol. in and unreactive towards liquid NH₈ **(5**, 988–989).—All are insol. in and unreactive towards liquid NH_3 at 25°. Fe_2O_3 was unchanged after treatment with liquid NH_3 containing a large excess of NH_4Cl or NH_4NO_3 , whilst under similar conditions NiO dissolved to a slight extent and Ni_2O_3 gave large yields of $Ni(NH_3)_8X_2$ (X = NO₃, Cl). Treatment with solutions of KNH₂ in liquid NH₃ gave unchanged NiO, a mixture of insol. products with Ni_2O_3 , and FeO and Fe with Fe_2O_3 . At 0° NiO is reduced to Ni by liquid NH₃ solutions of K. Ni_2O_3 and Fe_2O_3 catalyse the formation of KNH₂ from K in liquid NH₃ so that the oxides were not sensibly reduced. W. R. A.

Formation of nickel and cobalt silicates with planar lattices. Feithnecht and A. Berger (*Helv. Chim. Acta*, 1942, 25, 1543-1547).—Heating of a suspension of pure Ni(OH)₂ in H₂O in a sealed glass tube at $\sim 200^{\circ}$ during 30 hr. yields a product incompletely sol. in HCl. The insol. portion has an approx. composition 5NiO,8SiO₂,8H₂O and yields a characteristic X-ray diagram similar to that of other hydrated silicates, e.g., chamosite and antigorite.

The cell is orthobexagonal with a 5.33, b 9.24, c 7.25 A. The structure seems to comprise alternate planes of Ni(OH)₂ and SiO₂. When green basic Co bromide is heated with H₂O in a sealed tube at 2000 c 7.27 The struc- $\sim 200^{\circ}$ it yields a similar product with a 5-37, b 9.30, c 7.37 J. W. S.

X.—ANALYSIS.

Indicator having remarkable properties. G. Schwarzenbach (*Helv. Chim. Acta*, 1943, 26, 418–424).—The cation of 5-pyridinium-glutacondialdehyde perchlorate, $[O:CH:CH:CH:CH:CH:CH:NC_5H_5]^+$ (A., 1943, II, 172), is a dibasic acid of which the acid-base system is of the type A⁺ + OH⁻ \rightleftharpoons B⁻ + H⁺. As an indicator its colour change covers a very small pH range, and the salt effect and alcohol error are also very small. F. J. G.

Use of *p*-aminodimethylaniline as an indicator for free chlorine [in water].-See B., 1943, III, 164.

Colorimetric determination of ammonia with Nessler reagent. E Geiger (*Helv. Chim. Acta*, 1942, **25**, 1453–1469).—The reaction between NH_8 and K_2HgI_4 in alkaline solution attains an equilibrium state, being most complete at high [KOH] and reversed by the addition of KI. In 2-12N-KOH at 18-70° only Hg2ONH,I addition of KI. In 2-12N-KOH at $18-70^{-0}$ only $Hg_2ONH_{2}I$ is pptd., whereas in 0.0I-1N-KOH ($Hg_2ONH_{2}I$), HgI_2 is also pptd. and in 0.0I-0.1N-KOH pptn. is not quant. For the colori-metric determination of NH_3 it is recommended that the solution under test should be brought to an alkali content of 0.105-0.135N, with NaOH or KOH and then treated with K_2HgI_4 reagent. The latter is made up so as to contain excess of HgI_2 , which can react with K_2 K_1 K_2 K_2 K_3 K_4 K_2 K_3 K_4 K_4 latter is made up so as to contain excess of L_{2} with the KI formed in the reaction to yield further K_2 HgI₄. J. W. S.

Perchloric acid method for determination of silicon in ferrosilicon. See B., 1943, I, 297.

Detection of war gases. I. Dyes as reagents for detecting phos-gene. T. L. Pu and C. T. Lo (*J. Chinese Chem. Soc.*, 1941, 8, 140– 142).—72 dyes have been tested as reagents for $COCl_2$. Me-violet, Me-violet B, gentian-violet B, and rosaniline give colour changes with 0.7 mg. of COCl₂ per l. within 1 sec. (test papers exposed to vapour from 1% COCl₂ in PhMe). A. LI.

Systematic analysis of the cations without the use of hydrogen sulphide. T. P. Chao and S. C. Hwang (J. Chinese Chem. Soc., 1941, 8, 21-31).—In the system suggested the cations are separated into groups by successive pptns. with HCl, dil H_2SO_4 and EtOH, $(NH_4)_2S$ in presence of NH_4OAc and excess of AcOH, and H_2PO_4 and excess of aq. NH₃. The separation and identification of the cations within each group are outlined in tables. J. W. S.

Determination of potassium with zinc cobaltinitrite, Y. C. Chen and S. S. Shen (J. Chinese Chem. Soc., 1941, 8, 12-14).—Zn cobalti-nitrite reagent, prepared by the method of Adams et al. (A., 1935, 1337), can be used for the determination of K. The results are as satisfactory as those obtained by pptn. with Na₃Co(NO₂)₆ and the filtrate from the separation of K can be used for determination of Na J. W. S. by pptn. with Zn uranyl acetate.

Removal of phosphate ions before determination of sodium by the zinc uranyl acetate method. Y. C. Chen and S. S. Shen (J. Chinese Chem. Soc., 1941, 8, 7-11).—Both the $ZrOCl_2$ and Sn methods are suitable for the removal of PO₄" prior to the determination of Na by pptn. with Zn uranyl acetate in solutions containing 0.05-1 mg, of Na and 1.5 mg, of PO₄⁽¹⁾ per ml. in the presence of traces of K, Ca,</sup> or Mg. The ZrOCl₂ method is particularly efficient and rapid.

W. S. Spectrochemical determination of potassium in brine solutions.-See B., 1943, I, 282.

Determination of calcium by precipitation with picrolonic acid and polarographic measurement of residual picrolonic acid. G. Cohn and I. M. Kolthoff (*J. Biol. Chem.*, 1943, **147**, 705-719).—In the method described, dissolved Ca (concn. 0.001-0.01M) is treated with excess of 0.01M-picrolonic acid (I) after addition of AcOH-LiOAc-LiCl buffer and the mixture is maintained for 12 hr. at 0° for [Ca] $>5 \times 10^{-8}M$. or at $> 20^{\circ}$ when it is higher. The excess of (I) is determined polarographically without removing pptd. Ca picrolonate. The error is 1-2%. The amount of (I) required is deduced by comparing the turbidity produced on adding oxalate to a portion of the solution with that produced in a standard Ca solution or by measuring the time before pptn. of Ca picrolonate begins. Relatively large concns. of Na', K', NH₄', Mg'', SO₄", and PO₄" do not interfere. W. McC

Determination of zinc in aluminium alloys .--- See B., 1943, I, 302

Electrolytic determination of zinc in magnesium alloys .- See B. ·1943, I, 301.

Determination of zinc and cadmium cations with anthranilic acid. P. Wenger (*Helv. Chim. Acta*, 1942, 25, 1499–1500; cf. Funk, A., 1943, I, 42).—The micro-gravimetric determination of Zn by pptn. with anthranilic acid is equally accurate whether pptn. is brought about at room temp. or at 100° but for determination of Cd more accurate results are obtained by pptn. at 100°. J. W. S.

Reagents for cations. VIII. Reagents for cerium cations. P. Wenger and R. Duckert [with (Mlle.) Y. Rusconi] (*Helv. Chim. Acta*, 1942, 25, 1547-1552).—The disadvantages of various reagents which have been suggested for the detection of Ce are tabulated. The characteristics, sensitivities, and specificities of the following reagents recommended for use under various conditions are recorded : Na₂CO₃, phosphomolybdic acid, benzidine or o-tolidine, $o-NH_2 \cdot C_6H_4 \cdot CO_2NH_4$, CHPh(C₆H₄ · NMe₂-p)₂. I. W. S.

Quantitative spectrographic analysis of stainless steels.--See B., 1943, I, 297

Cobalt determination [in steel] by photo-electric comparison.—See B., 1943, I, 297.

Spot test for chromium [in steel].-See B., 1943, I, 297.

Determination of aluminium in high-nickel-chromium steels.— See B., 1943, I, 297.

Analytical study of thorium and cerium cations. P. Wenger and R. Duckert (*Helv. Chim. Acta*, 1943, 26, 416–418; cf. A., 1942, I, 410: also subra).—A correction. F. J. G.

XI.—APPARATUS ETC.

Weissenberg controlled-temperature technique. N. W. Buerger (*Amer. Min.*, 1942, 27, 217-218).—A heating accessory permits powder photographs of single crystals heated at various temp. to be L. S. T.

Attempts at obtaining excitation of an atomic beam of monatomic hydrogen. W. E. Williams (*Rev. Mod. Physics*, 1942, 14, 94–95). **hydrogen.** W. E. withinks (*Rev. Mod. Physics*, 1942, 14, 94–95)... It was found possible to excite an at. beam of H by means of an oscillator (100 w., λ 5·2 m.) using an arrangement of 5 fore slits in parallel, and Hg diffusion pumps of 1000 l. per sec. pumping speed. The Hg spectrum, however, was also present, and the beam was only slightly brighter than the background. A. J. M.

Atomic beam light sources applied to the structure of the magnesium I resonance line. R. A. Fisher (*Rev. Mod. Physics*, 1942, 14, 79–81).—A spectroscopic source, making use of an at. beam produced in an electrodeless ring discharge in A, has been constructed, and was used to excite the resonance lines of Mg I and II. Examination of the structure of the Mg I resonance line $\lambda 2852$ A, shows three resolved components corresponding to the three Mg isotopes 24, 25, 26, with abundance ratios 7:1:1. A. J. M.

Atomic beam apparatus for studying the atomic spectra of gases, especially hydrogen. J. E. Mack and E. C. Barkofsky (*Rev. Mod. Physics*, 1942, 14, 82–93).—An apparatus has been designed for the examination of H_a . Geometrical considerations affecting the the examination of H_a . Geometrical considerations affecting the construction of apparatus for this purpose are dealt with. In at, beam apparatus for use with gases, the pressure ratio of the final and initial chambers must be \ll the solid angle subtended by the first slit at a point in the field of view, and the region in which atoms are excited should not extend far beyond the full portion of the heam. The Doppler affect for a line smither from the text of the section. the beam. The Doppler effect for a line emitted from an at. beam is considered and it is shown that five factors contribute to it, some of which produce broadening and others frequency shifts. It is possible to keep the broadening low enough to obtain complete resolution of the electronic structure of Ha. A. J. M.

Application of atomic beams in spectroscopy. K. W. Meissner (Rev. Mod. Physics, 1942, 14, 68-78).—The advantages of at. beams in spectroscopy, particularly in reducing the width of spectral lines without the use of low temp., are considered. The construction of at. beam apparatus for use in the absorption, fluorescence, and electron impact methods is described. The applications of the method to intensity distribution in lines, fine structure, hyperfine structure, the Zeeman effect of hyperfine structure, and the inverse Stark effect are reviewed, and some further applications are A. J. M. indicated.

Infra-red prism spectrograph as a precision instrument. R. A. Oetjen, C. L. Kao, and H. M. Randall (*Rev. Sci. Instr.*, 1942, 13, 515—523).—The working conditions of a modified recording spectrometer of the Randall and Strong type (cf. A., 1931, 1387) have been examined. The max. speed of operation is determined by the recording apparatus. Changes of response characteristics of the recording apparatus. Changes of $\sim 0.5^{\circ}$ in the prism temp. cause appreciable errors in λ measurements, and temp. control or correction for temp. changes is essential. Mechanical imperfections render calibration tests necessary at frequent intervals. Calibration by comparison with grating spectra should be carried out with data obtained at a resolution equal to that of the prism instrument; the fine structure of absorption bands of CO_2 (15.4—13.9), NH₃ (14.0—7.9), and H₂O (7.9—5.0 μ .) has been examined at a resolution suitable for calibration of a NaCl prism, and 150 sharp calibration points are listed. The accuracy attained is $\pm 0.001 \ \mu$. at 15 μ ., or $\pm 0.005 \ \mu$. at 5 μ . A. J. E. W. is $\pm 0.001 \ \mu$. at 15 μ ., or $\pm 0.005 \ \mu$. at 5 μ .

Carbon arc in oxygen for the spectrochemical determination of potassium. L. T. Steadman (*Physical Rev.*, 1943, [ii], 63, 322, 399).---The adverse effect of the high background and the lines of CN bands due to atm. N_2 is remedied by a partial replacement of N_2 by O_2 A technique is described, and its use in the analysis of blood serum is N. M. B. indicated.

Application of the Hirschmüller-Bechstein photoelectric colorimeter to steel analysis.—See B., 1943, I, 297.

Photoelectric spectrophotometer for analytical research. D. E. Howe (*Iowa State Coll. J. Sci.*, 1942, **17**, 82–84).—The design of a spectrophotometer giving results of the same order of accuracy as a commercial instrument but being simpler, smaller, less expensive, and requiring less highly trained operators for manipulation is I. W. S. described.

Slotted cylindrical rotors for photometric calibration. J. R. Platt, H. E. Clark, A. A. Cohen, and P. A. Caldwell (*Rev. Sci. Instr.*, 1943, 14, 85–88).—The use of hollow cylindrical rotors with slotted walls as substitutes for sector discs for some photometric applications is described, designs for rotors which can replace a logarithmic sector, fixed sector disc, step sector, and variable sector disc being given. A rotor corresponding with the latter and adjustable inside a vac. J. L. E. system has been constructed.

Method of preparing strips with uniformly varying blackening. E. S. Barr and L. B. Scott (*Rev. Sci. Instr.*, 1942, **13**, 533-534).--A strip of sensitised film is supported on a curved surface designed to give a suitable continuous variation of the angle of incidence of a parallel beam of light. An equation is given for the curve required for a linear variation of blackening. A. J. E. W.

Monochromator using a large water prism. C. V. Cannon and O. K. Rice (*Rev. Sci. Instr.*, 1942, 13, 513-514).—The inexpensive instrument described employs a constant-deviation, totally-reflecting H₂O prism built from quartz plates, with a massive metal frame to minimise temp. gradients. A. J. E. W.

Supermicroscopy with a reaction chamber, using the universal electron microscope. M. von Ardenne (Z. physikal. Chem., 1942, B, 52, 61-71).—The construction of a reaction chamber which can be used with the universal electron microscope is described. With its aid it is possible to examine objects under pressure, and the effect of gases on substances can also be followed. A. J. M.

Temperature-controlled X-ray powder camera. M. J. Bue N. W. Buerger, and F. G. Chesley (Amer. Min., 1942, 27, 217). Buerger, L. S. T.

Differential polarography and polarometry. G. Semerano and L. Riccoboni (Gazzetta, 1942, 72, 297-304).-Many of the difficulties G. Semerano and L. of polarography are avoided by employing two identical dropping electrodes in parallel and two solutions, identical except that one only contains the substance (I) being determined. A recording galvanometer is connected across the two circuits, and records only the depolarisation current due to (I), eliminating effects due to O_2 or other substances (even in quantities which would make normal polarography impossible), or to external causes; except when the drops from the two electrodes are out of phase, and a sensitive drops from the two electrodes are out of phase, and a construct galvanometer is employed, a continuous graph is obtained. A polarometric method is proposed, based on quant. addition of (1) to the control solution until the displacement due to its presence in the other is eliminated. E. W. W. in the other is eliminated.

Determination of half-value periods from observations with a single Geiger counter. A. G. Ward (Proc. Roy. Soc., 1942, A, 181, 183-197).-The coincidence circuit described makes possible the determination of half-val. periods between 10^{-4} and 1 sec. by the use of a single Geiger counter. The periods of Ac-A, Th-A, and Ra-C' have been determined. The limitations and sources of error of the method are discussed. G. D. P.

High-temperature stopcock greases. I. E. Puddington (J. Amer. Chem Soc., 1943, 65, 990-991).-Stopcock greases composed of 15-25% of Li or Al stearates in mineral oil are described.

W.R.

Tyre valve in vacuum application. C. H. Bachmann and I. B. Bensin (*Rev. Sci. Instr.*, 1942, **13**, 534-535).—The valve is operated by an extension wire welded to the high-pressure side of the valve rod, or by a lever acting through vac.-tight bellows. A. J. E. W.

Laboratory liquid air storage. J. R. Roebuck (*Rev. Sci. Instr.*, 1943, 14, 90-97).—The design and construction of a 120-1. triplewall, Ag-plated, metal vac. vessel for containing liquid air are described. The radiation theory for its part of the evaporative loss has been worked out, the calc. loss being in agreement with the observed loss of 3 kg. per day. J. L. E.

XIII.—GEOCHEMISTRY.

Gold content of the sea. W. Stark (Helv. Chim. Acta, 1943, 26, 424-441).—The waters of the Adriatic, the Mediterranean, and the

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Atlantic contain respectively 0.02, 0.4, and 2.0 mg. of Au per cu. m. A sample of seaweed contained 0.17 mg. of Au per 1000 g. of dry material. F. J. G.

Separation of electricity in clouds. (Sir) G. C. Simpson (*Phil. Mag.*, 1943, [vii], **34**, 285–287).—A reply to Chalmers (cf. A., 1943, I, 104). L. J. J.

Wind-borne dust collected in May, 1942. A. Sen (Current Sci., 1943, 12, 55).—Mechanical and chemical analyses of dust from dust-storms, collected in Delhi, are given. The dust appears to be soil from a very arid zone. A. J. M.

Interior of the earth viewed in relation to earthquake causes. II. What radioactivity tells us about the interior of the earth. V. F. Hess (*J. Appl. Physics*, 1943, 14, 116-120).—Recent estimates of the total radioactivity of the earth's substance are reviewed. The observed γ -ray ionisation in ionisation chambers placed over land and water is > that calc. from Evans and Goodman's radioactivity data. L. J. J.

Origin of sulphides in the nickel deposits of Mount Prospect, Connecticut. E. N. Cameron (*Amer. Min.*, 1942, 27, 218).—The ores are noritic and pyroxenitic rocks containing varying amounts of pyrite, pyrrhotite, pentlandite, and chalcopyrite. The sulphides are probably of magmatic or late magmatic origin, and have been formed chiefly by fracture filling and by replacement of the various silicates. L. S. T.

Distribution of trace elements in the rocks of the Skaergaard intrusion, Greenland. L. R. Wager and R. L. Mitchell (*Min. Mag.*, 1943, 26, 283—296).—Spectrographic analyses were made for a no. of elements in the olivine-gabbro representing the original magma and in the series of rocks (gabbro-picrite, olivine-gabbro, ferrogabbro, basic hedenbergite-granophyre, and acid granophyre) produced by fractional crystallisation. The undifferentiated olivine-gabbro gave results agreeing with an average gabbro except that Sr is ten times more abundant. Cr and Ni tend to be conc. in the earlier basic differentiates, V and Co in the early middle, Cu and Li in the late middle, whilst Mo, Zr, Th, La, and Rb are conc. in the latest differentiate, the acid granophyre; Ba shows a continuous and marked increase in amount throughout the whole range of the differentiation series. L. J. S.

Brammallite (sodium-illite), a new mineral from Llandebie, South Wales. F. A. Bannister (*Min. Mag.*, 1943, **26**, 304–307).—White coatings on coal-measure shales consist of tufts of minute flakes, with $n \alpha 1.561$, $\gamma 1.579$, and X-ray spacings a 5.2, b 9.0, $c \sin \beta 19.2$ A., and containing Na₂O 5-22, K₂O 2.58%. These data are compared with those for paragonite, illite, muscovite, and hydromuscovite.

L. J. S.

Rare occurrence of melilite-diopside-nepheline association in a calciphyre near Nanjangud, Mysore. B. R. Rao (*Current Sci.*, 1943, 12, 54).—The occurrence of melilite and nepheline in calciphyres in Mysore has been discovered. This throws some light on the mode of origin of the melilite rocks, which seem to have been formed, in this region, from reactions between an older, impure, dolomitic limestone and later injected alkaline liquids connected with granitic inclusions. A. J. M.

Lead-uranium-thorium ratios of various zones of a single crystal of uraninite from Spruce Pine, N. Carolina. C. M. Alter and E. S. McColley (*Amer. Min.*, 1942, 27, 213).—Analyses for Pb, U, Th, and acid-insol. material from the outer and middle zones, and the core, are given. The ratios Pb/(U + 0.36Th) are 0.0471, 0.0486, and 0.0503, respectively, corresponding with approx. ages of 358, 369, and 382 $\times 10^6$ years. L. S. T.

Chromite deposits of the Philippine Islands. D. F. Frasche (*Amer. Min.*, 1942 **27**, 221).—The deposits occur in isolated masses of ultra-basic rocks, which are highly serpentinised and are composed essentially of dunite, saxonite, and pyroxenite rock types. The commercially-important deposits appear to be confined to the serpentinised dunite. Gabbro and diorite intrude the deposits locally, but are confined to the ore bodies of refractory grade. The chromite (**I**) is considered to be genetically related to the dunite, and is probably of early magmatic origin. Philippine reserves of all grades of (**I**) are estimated to be 10,890,500 m. tons. L. S. T.

Analysis and age of monazite from Deer Park No. 5 mine, Spruce Pine, N. Carolina. A. D. Bliss (*Amer. Min.*, 1942, 27, 215).—The monazite contains Th 4.81-4.86, Pb 0.131-0.134%, and, possibly, U 0.01%. The calc. age is 6×10^8 years. L. S. T.

Scheelite deposits in the Greenhorn mountains of the Southern Sierras. N. C. Dale (*Econ. Geol.*, 1942, 37, 84-85). L. S. T.

Tin deposits of Carguaicollo, Bolivia. F. S. Turneaure and R. Gibson (*Econ. Geol.*, 1942, 37, 84). L. S. T.

Clay minerals in recent marine sediments. R. S. Dietz (Amer. Min., 1942, 27, 219—220).—The clay fractions of 39 sediments from the various oceans of the world have been investigated. The particles of the red clay samples are coarser than those of the green and blue muds which, in turn, are usually coarser than clays in tidal estuaries, bays, inland seas, river sediments, and soil clays. Marine clays probably undergo a post-depositional increase in grain size. X-Ray and petrographic examinations show that illite (I), kaolin (II), and montmorillonite (III) are also the main constituents of marine clays, with (I) predominating. Small amounts of (III) occur in near-shore sediments, but not in those from the deep sea. (II) and (III) are formed on the sea floor by the alteration of the felspars in granite. (II) may form by the alteration of some primary minerals and especially by alteration of (III); this change involves adsorption of K from sea-H₂O into (III), and may, *inter alia*, account for the low K : Na ratio in sea-H₂O as compared with that of river-H₂O. L. S. T.

Nature and origin of the Edwin clay, Ione, California. T. F. Bates (Amer. Min., 1942, 27, 214).—This clay is a highly refractory kaolin clay used for manufacturing firebricks. It has been formed from laterite. L. S. T.

Nature of Georgia kaolin. I. Chemical and colloidal analysis. II. Mineralogical analysis. L. Mitchell and E. C. Henry (*J. Amer. Ceram. Soc.*, 1943, 26, 105—113, 113—119).—I. The clays are sedimentary Cretaceous kaolins, probably deposited in off-shore lakes where salt and fresh H_2O met. All are rich in Al_2O_3 and deficient in SiO₂ beyond the kaolinite ratio. The low Fe_2O_3 and MgO contents indicate that the clays do not contain montmorillonite (with one exception where it is a contaminant) but are essentially kaolinitic. The morin dye test for Al¹¹ indicates that some of the clays (particularly the hard varieties) release the ions more readily than others, probably due to the presence of halloysite or perhaps imperfectly cryst. kaolinite. The soft clays have a larger grain size than the hard clays. The viscous behaviour of the clay slips is not well correlated with the hardness owing to the peculiar distribution of grain size, the grain shape, and the presence and nature of the org. matter. Soft kaolins have the lowest and the hard kaolins the highest base-exchange vals.

II. Thermal and X-ray analyses confirm that the soft kaolins contain a high proportion of cryst. kaolinite whereas the hard clays contain less well-cryst. material. The degree of crystallisation, grain size, the nature and amount of the org. matter, and the admixture of different minerals explain the different behaviour of the clays. J. A. S.

Dehydration study of clays. L. H. Berkelhamer (J. Amer. Ceram. Soc., 1943, 26, 120–126).—20 clays were dehydrated at 300° to a const. wt. and then rehydrated by exposure to a H₂O-saturated atm. at 30° for 28–80 days. After 10 hr. of rehydration the montmorillonite (I) and halloysite (II) clays showed marked hydration whilst the kaolinite clays had rehydrated to the same extent (6%) only after ~1000 hr., by which time (I) had rehydrated to ~36%. (II) were distinguished from (I) by the fall in rate of rehydration after 50 hr. (II) was saturated after 1000 hr. but the other clays were still rehydrating after 1000 hr. and after 1500 hr. in some cases. A test made by dehydration of duplicate samples at 300°, followed by a 2-hr. rehydration period at 65° for one sample and a 2-hr. dehydration period at 600° for the other sample, is a quick (5 hr.) and simple method of identifying the main clay mineral types. J. A. S.

Stratigraphical arrangements and occurrence of torbanite deposits in the Upper Kamilaroi coal measures of New South Wales. J. A. Dulhunty (Proc. Linnæan Soc. N.S. Wales, 1942, 67, 123-141)...-The deposits occur interbedded with the coal measure sediments as isolated lenticular seams the lateral extent of which varies from 6 miles to <0.5 mile. The association of torbanite with bituminous and cannel coals is described. The palæogeographical distribution of the torbanite deposits and their relation to coal-measure stratigraphy are dealt with. The individual deposits are described in detail and proximate analyses given. R. B. C.

Mica of certain coal-measure shales in South Wales. G. Nagelschmidt and D. Hicks (*Min. Mag.*, 1943, 26, 297-303).—Chemical analyses are given of six shales overlying anthracite and bituminous coal, and of the fine fractions separated from each. These and X-ray analysis show that the fine fractions contain illite with $\sim 10\%$ of kaolin and 1% of quartz. Dehydration, optical, and baseexchange data are also given, and the conditions of formation and stability of illite are discussed. The Na content of illite decreases slightly with decreasing rank of the associated coal, suggesting that anthracite was formed under alkaline conditions. L. L. S.

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