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

NOVEMBER, 1940.

Arc spectrum of ytterbium between 2200 and 5000 A. for $2 \times 10^{-4}, 2 \times 10^{-5}, 2 \times 10^{-6}, 2 \times 10^{-7}$, and 2×10^{-8} g. J. M. López de Azcona (Anal. Fís. Quím., 1940, **36**, 72—75).—In mixtures of $Yb_2(SO_4)_3,8H_2O$ with Hg_2O, Yb can be identified by the 3289.37 A. line at a concn. of 2×10^{-8} g. and by 2891.38 A. at 2×10^{-7} g. Analogous data on other Yb lines are recorded for concns. of $2 \times 10^{-6}, 2 \times 10^{-5}$, and 2×10^{-4} g.　　　　F. R. G.

Spectrum of *RW* Hydrae. P. Swings and O. Struve (Proc. Nat. Acad. Sci., 1940, **26**, 458—461).— 53 sharp emission lines, belonging mainly to H, He I, and O III series, have been identified between 3266 and 6563 A. The variable consists of a late-type component of spectral class $M0$ or late K with radial velocity $+15$ km. per sec., and a highly excited companion with radial velocity $+14$ km. per sec. giving Balmer lines to H_{22} with a continuum to 3300 A. and the He and O lines. Weak O II, Si I, and Ca II lines and fairly strong He II and Ne III lines are also observed.　　　　L. J. J.

Impact broadening of spectral lines. L. Spitzer, jun. (Physical Rev., 1940, [ii], **58**, 348—357; cf. A., 1939, I, 501).—Mathematical. It is shown that the combined errors introduced into current impact broadening theory by the assumption of the incorrect adiabatic approximation and by neglect of the rotation of the adiabatic electron states have fortuitously led to approx. true results. A correct treatment of these effects is developed by taking as electronic states the eigenfunctions in a non-rotating, stationary co-ordinate system.　　　　N. M. B.

Zeeman effect in krypton and xenon. J. B. Green, D. W. Bowman, and E. H. Hurlburt (Physical Rev., 1940, [ii], **58**, 381).—Discrepancies and agreements between experimental and theoretical g vals. resulting from measurements of the Zeeman effect of ~ 150 lines in the spectrum of Kr I and about the same no. in Xe I are discussed.
　　　　N. M. B.

What we have learned from scattered X-rays. A. H. Compton (J. Franklin Inst., 1940, **230**, 149—157).—Franklin medallist's address on the history and significance of 20 years' investigations of X-ray scattering.　　　　W. R. A.

Reduction of breakdown potential at high frequency. H. Böcker (Arch. Elektrotech., 1937, **31**, 166—179; Chem. Zentr., 1937, i, 4606).—The breakdown potential (E) in a gas discharge tube falls as the frequency (ν) of the a.c. increases above a crit. val. Expressions derived for ΔE in terms of ν agree with experimental data.　　　　A. J. E. W.

Multiple scattering of fast electrons and α-particles, and "curvature" of cloud tracks due to scattering. E. J. Williams (Physical Rev., 1940, [ii], **58**, 292—306).—Mathematical. A revision of the theory of multiple scattering (cf. A., 1939, I, 291) indicates that observed discrepancies must be due to experimental error or to a failure of the basic collision theory. Previous theoretical results are extended to a theory of the multiple scattering of α-particles and recent views are examined (cf. Sheppard, A., 1940, I, 185; Goudsmit, *ibid.*, 89).　　N. M. B.

Polarisation of electrons by double scattering. C. B. O. Mohr and H. S. W. Massey (Nature, 1940, **146**, 264).—Polarisation effects arising from scattering by the at. fields of Au, Xe, and Kr, *i.e.*, screened Coulomb fields, have been investigated for a wide range of electron energies (100—150,000 e.v.). In the energy range covered by Mott's calculations for the unscreened field of the Au nucleus, introduction of screening has no important influence, and the failure to obtain the predicted asymmetry remains unexplained. In scattering by Au, the effect of screening makes possible the existence of large polarisation in small energy ranges at low energies. The spherical potential well also gives rise to polarisation effects, which tend to occur in narrower energy regions than for a Coulomb field.　　　　L. S. T.

Electric quadrupole moment of the deuteron. A. Nordsieck (Physical Rev., 1940, [ii], **58**, 310—315).—Mathematical. The gradient of the electric field at the nucleus in the H_2 mol. is calc. from a new electronic wave function which gives a simple but accurate formula for the electron density. The calc. field gradient, with the mol. beam measurements of Kellog (cf. A., 1940, I, 275), confirms ($\pm 2\%$) the val. 2.73×10^{-27} sq. cm. for the electric quadrupole moment of the deuteron.　　　　N. M. B.

Scattering of thermal neutrons by crystals. F. Rasetti (Physical Rev., 1940, [ii], **58**, 321—325; cf. Whitaker, A., 1940, I, 186).—The effect of crystal interference on the scattering coeff. for thermal neutrons was investigated under various conditions. Calcite shows a large interference effect, the effective mol. cross-section for scattering by a single crystal being $\sim \frac{1}{3}$ that for a microcryst. aggregate. A single crystal becomes more transparent when the velocity of the neutrons is decreased. Measurements for Bi and P, where the difference is less pronounced, are given. Mass scattering coeffs. for Pb are : solid 0.028 ± 0.002, liquid 0.027 ± 0.002; single crystal 0.0213 ± 0.001, microcryst. 0.0275 ± 0.001; and for Bi : single crystal 0.019 ± 0.001, liquid $0.024 \pm$

0·002, single crystal at 300° K. 0·0184±0·0005, at 80° K., 0·0171±0·0005. N. M. B.

Photographic plate spectrum of d–d neutrons. H. T. RICHARDS and E. HUDSPETH (Physical Rev., 1940, [ii], **58**, 382; cf. A., 1940, I, 307).—Magnetically analysed 700-kv. deuterons fell on a heavy paraffin target ~20 kv. thick for 1 μ-amp. hr. An analysis of photographic plates 12 cm. from the target at 0° and 90° to the bombarding beam shows no evidence of a short-range group of recoils. It is concluded that the radiative capture cross-section is ⧸0·01 of the scattering cross-section for 2·5-Me.v. neutrons, and that there is only a single group of neutrons, and no low-energy group of neutrons, from the d–d reaction. N. M. B.

Reactions of high-energy atoms produced by slow-neutron capture. W. F. LIBBY (J. Amer. Chem. Soc., 1940, **62**, 1930—1943).—Capture of slow neutrons by most nuclei leads to emission of γ-ray quanta followed by β-radioactivity and recoil of the emitting nucleus. The radioactive fragment will react with surrounding mols. and non-radioactive fragments in either of two ways : (a) requiring, (b) not requiring, a certain fraction of the recoil energy. These are termed respectively activated and thermal reactions. MnO_4' ions in solution yield $Mn^*O_3^{·}$ (principally), $Mn^*O_2^{···}$, $Mn^*O^{·····}$, and $Mn^{*·······}$ ions all of which in neutral or acid solutions oxidise H_2O readily, and in alkaline solution combine with OH' to form MnO_4'. In solutions of low p_H the interchange $Mn^*O_3^{·} + MnO_4' = MnO_3^{·} + Mn^*O_4'$ occurs. Data for solid $KMnO_4$ are also discussed. MnO_4' and MnO_4'' readily interchange an electron (probably 3d). P^V, As^{III}, and As^V mols. and ions, and ClO_3', BrO_3', IO_3', and ClO_4' ions, have also been similarly investigated. The recoils from P^V mols. and ions appear to eject oxidised O_2 leaving, about half the time, P^{III} and retaining ~50% activity. As^{III} and As^V expel −2 bivalent O_2 and the retention is 100%. Halogenate ions are reduced by ejection of −1 or at. O, and they also interchange with mol. halogen in acid solution, the rates of interchange being Cl < Br < I. The ClO_4' ion, however, does not rapidly interchange with Cl_2. Retention by org. halides and the effect of dilution on retention by these compounds have also been investigated. W. R. A.

β-Radiation from ^{27}Si and ^{30}P. W. H. BARKAS, E. C. CREUTZ, L. A. DELSASSO, R. B. SUTTON, and M. G. WHITE (Physical Rev., 1940, [ii], **58**, 383).—From the momentum spectra obtained in an alcohol-air-filled cloud chamber the upper limits of the positrons from ^{27}Si, formed by the reaction ^{27}Al (p, n) ^{27}Si, and from ^{30}P, formed by the reaction ^{30}Si (p, n) ^{30}P, were found to be 3·54±0·1 and 3·0±0·1 Me.v., respectively. The former val. is slightly > the 3·4 Me.v. expected on the basis of a nuclear vol. ∝ the mass no. (cf. A., 1939, I, 592). N. M. B.

Fission products and induced β-ray radio-activity of uranium by fast neutrons. T. YASAKI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1940, **37**, 457—472).—The fission products obtained from U when U_3O_8 is irradiated with fast neutrons are : $^{112}_{46}Pd$ (26 min.; 17 hr.); $^{111}_{47}Ag$ (7·5 days); $^{112}_{47}Ag$ (3·5 hr.); $^{115}_{48}Cd$ (56 hr.), $^{117}_{48}Cd$ (3 hr.), $^{?}_{48}Cd$ (50 min.); $^{115}_{49}In^*$

(4·5 hr.), $^{117}_{49}In$ (2 hr.). A method for their separation is described. Irradiation by fast neutrons induces β-activity in U. W. R. A.

Determination of the mean number of neutrons set free in the splitting of a uranium nucleus. H. BRADT (Helv. Phys. Acta, 1939, **12**, 553—558). —The mean no. of neutrons set free in U fission was found, by the method of Fermi (Ric. Sci., 1936, **72**, 13), to be 2·9₅±0·5. O. D. S.

Observation of showers and nuclear transmutation with cosmic rays in an ionisation chamber. H. EULER (Naturwiss., 1940, **28**, 141—142).—To discover whether the smaller collisions in an uncovered chamber are nuclear transmutations the effect of pressure can be investigated. Another method is to determine the frequency of simultaneous ionisation collisions in two adjacent uncovered chambers. The effect of nuclear transmutations is to give rise to a sudden increase in the slope of the collision distribution curve. A. J. M.

Absorption of cosmic rays in thick layers. I. Absorption experiments with iron. K. ALEXO-POULOS (Praktika, 1936, **11**, 398—404; Chem. Zentr., 1937, i, 4735).—Triple-coincidence counter measurements are used to test Auger's view that the mass absorption coeff. (k) for hard cosmic radiation is independent of the at. no. of the absorbing element. k for Fe is 0.9×10^{-3} g.$^{-1}$ cm.^{2} A. J. E. W.

Time-variations in cosmic-ray intensity at high altitudes. W. P. JESSE (Physical Rev., 1940, [ii], **58**, 281—287; cf. A., 1940, I, 189).—Balloon flight observations over a year show marked intensity changes, with a max. variation of ~14% for the peak val. of the ionisation–pressure curve. After correction for the " world-wide " variations at ground stations, the residual variations show a max. in the early spring, falling to lower vals. in the summer, and increasing in the autumn, with some indication of relations to magnetic changes. N. M. B.

Fine structure in the directional intensity of cosmic rays. D. COOPER (Physical Rev., 1940, [ii], **58**, 288—292; cf. A., 1939, I, 445).—Using a triple-coincidence circuit of counters, an investigation of fine structure in the zenith-angle distribution of cosmic-ray intensity in the zenith-angle range 0—45° for various directions shows intensity patterns with small oscillations. The prominences measured in terms of the largest positive deviations from the $\cos^2 \theta$ curve are ~2—3% of the intensity, and occur at ~7°, 20°, and 37°. The directional intensity pattern shows an approx. symmetry about the zenith. Results tend to confirm Schremp's fine-structure predictions (cf. A., 1940, I, 188). N. M. B.

Absorption of heavy corpuscles. Ş. TITEICA (Bull. Soc. Roum. Phys., 1936, **37**, No. 65, 3—13; Chem. Zentr., 1937, i, 3763; cf. Z. Physik, 1936, **101**, 378—397).—Thomas–Fermi statistics show that the mean excitation energy of an atom (at. no. Z), on which its scattering power depends, is kZ. The calc. val. of k is 9·5 (±40%), in agreement with experiment. A. J. E. W.

Statistical mechanics of co-operative phenomena. J. G. KIRKWOOD (J. Chem. Physics, 1940,

8, 623—627).—Mathematical. Using local free energies, a direct method of successive approximation to the configurational partition function has been developed. W. R. A.

Spin–orbit coupling in ^{5}He. S. M. DANCOFF (Physical Rev., 1940, [ii], **58**, 326—331).—Mathematical. Experimental results on the splitting of the ground state of ^{5}He (cf. Staub, A., 1940, I, 307) are compared with the structures expected on the basis of Thomas relativistic spin–orbit coupling and of tensor spin–orbit interaction of mesotron theory. The former gives an unsatisfactory result, and the latter a result of the same order of magnitude as the experimental splitting and of the " normal " structure. N. M. B.

Superconductivity. K. R. DIXIT (Current Sci., 1940, **9**, 274—275).—If interaction between lattice and conductivity electrons becomes negligible at a very low temp., superconductivity will ensue and the conductivity electrons will precess in a magnetic field, giving a diamagnetic susceptibility of $\sim 1/4\pi$. Observed finite vals. of superconductivity may be due to the small second-order interaction between nuclear and electron spins which is responsible for the hyperfine structure of spectral lines. L. J. J.

λ 3105, λ 3338, and λ 3375 bands of OD. M. ISHAQ (Current Sci., 1940, **9**, 275—276).—Rotational consts. of OD are recorded and compared with those of OH. The structure is characteristic of a $^2\Sigma \rightarrow {}^2\Pi_{inv.}$ transition. L. J. J.

Nuclear isotope shift in the spectra of HgH$^+$ and HgD$^+$. S. MROZOWSKI (Physical Rev., 1940, [ii], **58**, 332—340; cf. A., 1940, I, 138).—Lines in the band spectra of HgH$^+$ and HgD$^+$ excited in a hollow-cathode tube and studied with Fabry–Perot etalons show broadening with traces of structure due to isotopic effect. There is no anomalous behaviour of components belonging to the odd Hg isotopes due to hyperfine splitting, but the half-widths differ widely from those expected. From the measured half-widths the shifts between consecutive even isotopes are evaluated and compared with those calc. from isotope effect. The differences represent the additional shifts which must be explained as nuclear isotope shifts. Consideration of the data on the nuclear isotope shifts in HgH, HgH$^+$, Hg I, and Hg II leads to conclusions on the deformation of the electron clouds in Hg and Hg$^+$ caused by the attachment of H, and a rough calculation of the nuclear shifts in the mol. levels of of HgH and HgH$^+$. N. M. B.

Estimation of ground state dissociation energies of di-atoms of symmetrical molecular groups. C. H. D. CLARK (Proc. Leeds Phil. Soc., Sci. Sect., 1940, **3**, 597—602).—Two relationships, formerly applied to the fundamental vibration frequencies of di-atoms of symmetrical mol. groups (e.g., LiLi, NaNa, etc.), have been considered with a view to their application to the estimation of dissociation energies of di-atoms. The expressions are : (1) $\log D = p - n \log 2Z$ (D = dissociation energy; p, n are group consts. of the di-atoms, and Z is at. no.); (2) $a^n = kbc^{n-1}$ (a, b, c are ground dissociation energies of the di-atoms XY, XX, and YY). Results obtained from both relationships agree satisfactorily with experiment, and with those obtained formerly by the use of an independent empirical equation. A. J. M.

Spectrum of P$_2$ molecule. G. HERZBERG, L. HERZBERG, and G. G. MILNE (Canad. J. Res., 1940, **18**, A, 139—143).—Five bands of the ultra-violet system of P$_2$, with low v' and v'' vals., have been analysed and the following vals. determined with a greater accuracy than previously possible : rotational consts. B_e'' and α_e'', 0·3031 and 0·00138 cm.$^{-1}$; moment of inertia, I_e'', 92·36 $\times$ 10^{-40} g.-cm.^{2}; inter-nuclear distance, r_e'', 1·895 $\times$ 10^{-8} cm. D. F. R.

Absorption spectra of indium chloride, indium bromide, indium iodide, and gallium chloride in the Schumann region. M. WEHRLI and W. WENK (Helv. Phys. Acta, 1939, **12**, 559—560).—Between 1580 and 5000 A. InCl$_2$, InBr$_2$, InI$_2$, and GaCl$_2$ show four regions of continuous absorption the positions of which shift towards the red on passing from InCl$_2$ through InBr$_2$ to InI$_2$. InCl and InBr decompose photochemically in this region to an excited halogen atom and an excited, ^2S, In atom which emits the lines at 4511 and 4102 A. O. D. S.

Ultra-violet absorption of cobalt salts and some light filters for the ultra-violet region. H. L. J. BÄCKSTRÖM (Arkiv Kemi, Min., Geol., 1940, **13**, A, No. 24, 16 pp.).—Aq. solutions of pure CoSO$_4$ and of NiSO$_4$ have a high degree of transparency for ultra-violet. The transparency is considerably decreased by impurities. Mixed conc. aq. solutions of the two salts may be used as filters for the ultra-violet, transmitting $\lambda\lambda$ 220—340 mμ. more or less completely, and absorbing longer $\lambda\lambda$. By combining these filters with supplementary ones it is possible to isolate definite $\lambda\lambda$. A method for preparing the pure salts from the commercial products is described. A. J. M.

Investigation of hydrogen bonds by infra-red absorption spectra. G. B. B. M. SUTHERLAND (Trans. Faraday Soc., 1940, **36**, 889—897).—The interpretation and the theoretical basis of modifications in the vibration frequency of X–H bonds caused by various types of association are discussed. F. L. U.

Infra-red absorption of the hydroxyl group in relation to inter- and intra-molecular hydrogen bonds. J. J. FOX and A. E. MARTIN (Trans. Faraday Soc., 1940, **36**, 897—911).—In dil. CCl$_4$ solution the O–H band of CH$_2$Ph·OH has components at 2·750 and 2·765 μ., probably denoting two slightly different mol. species of the monomeride. The extinction coeff. remains const. over the range 0·0005—0·03 mol. per l. At 0·067 and 0·170 mol. per l. equilibrium subsists between monomeric and dimeric (2·865 μ.) mols., and at higher concns. further polymerisation occurs, probably with the formation of a tetrameride. The position (~ 3 μ.) and intensity of the absorption due to the polymerides are very similar for the more conc. solution and the pure liquid. A sharp band at 2·776 μ. is attributed to a slight modification of the free OH present in the dimeride. An attempt is made to clarify the expression " energy of the H bond." F. L. U.

Spectra and molecular vibrations of glyoxal.

H. W. THOMPSON (Trans. Faraday Soc., 1940, **36**, 988—999).—The ultra-violet and infra-red (1—15 μ.) absorption spectra of $(CHO)_2$ vapour have been measured. Analysis of the data does not permit an unambiguous decision between the possible mol. structures, but does not exclude the planar *trans* structure for which some evidence exists (cf. Lu Valle and Schomaker, A., 1940, I, 101). The fluorescence spectrum excited by $\lambda\lambda$ 4047 and 4358 A. has been measured and correlated with the absorption spectrum. F. L. U.

Infra-red absorption studies of some hydrocarbons.

F. T. WALL and G. W. McMILLAN (J. Amer. Chem. Soc., 1940, **62**, 2225—2227).—The infra-red absorption spectra of C_6H_6, Ph_2, $C_{10}H_8$, anthracene, phenanthrene, indene, hydrindene, tetrahydronaphthalene, 9:10-dihydro- and *cis-as*-octahydrophenanthrene in CCl_4 have been investigated from 3·2 to 3·5 μ. The " aromatic " part of the mol. gives rise to bands at 3·2—3·3 μ., whilst the " aliphatic " gives bands in the region 3·45 μ. Hooke's law force consts. for the different kinds of C–H bonds have been evaluated. W. R. A.

Infra-red absorptions of organic hydroxyl compounds in the solid state in the 3 μ. region.

M. M. DAVIES (J. Chem. Physics, 1940, **8**, 577—587).—The absorption of thin films of various org. solids in the region 2·6 to 3·5 μ. has been investigated. Cetyl alcohol shows CH absorption at 3·4—3·5 μ. but the associational band is shifted by ~0·1 μ. to longer $\lambda\lambda$, indicating increased association of OH groups. Lauric acid and ω-hydroxyhexadecoic acid also give absorption curves indicative of enhanced association. The OH band of solid $CPh_3\cdot OH$ (I) has a doublet structure near 2·90 μ. with a frequency difference of 42 cm.$^{-1}$ between the two components, whereas in solution it is single and not so broad. The occurrence of a doublet OH peak is also established in solid mandelic (II) and α-hydroxymyristic (III) acids and $\Delta\nu$ is $\simeq$ that found for (I). The absorptions of CCl_4 solutions of (II) and (III) have also been investigated in the same region. $OH\cdot CHPh\cdot CO_2Et$ has been studied as a solid, as a liquid, and in CCl_4 solution ; there is a gradual transition from dil. solution to solid. Other compounds studied are : Et β-hydroxy-β-phenyl-β-diphenylylpropionate (solid and in CCl_4), *cis*- and *trans*-Me 9:10-dihydroxystearates (solid and in CCl_4), and solid pyrocatechol, resorcinol, quinol, and quinhydrone. Those mols. which show a narrow doublet structure near 2·90 μ. possess relatively " free " OH groups resulting from steric protection or from weak intramol. binding. W. R. A.

Rottlerin. VI. Spectrographic study of rottlerin and its derivatives.

R. A. MORTON and Z. SAWIRES (J.C.S., 1940, 1052—1064).—The absorption spectra of rottlerin, *iso*rottlerin, and many derivatives have been measured ; they are mainly determined by those of methylphloracetophenone. If the Ac group is replaced by $CHPh:CH\cdot CO$, a new factor enters into the spectra and there is a less important effect when chromen structures occur. There is qualitatively a predominant additive effect in the spectra, but constitutive effects are more significant for intensities of

absorption. A large no. of relatively simple substances have been examined, and the data used in an extended correlation between structure and absorption. The Me ethers give rise to interesting anomalies having rather wide implications. F. R. S.

Ultra-violet absorption spectra of nitrogenous heterocyclic compounds. II. Effect of p_H and irradiation on the spectrum of barbituric acid.

J. R. LOOFBOUROW and (MISS) M. M. STIMSON (J.C.S., 1940, 1275—1277).—The triketonic form of barbituric acid (I), $CO\!\!<\!\!^{NH\cdot CO}_{NH\cdot CO}\!\!>\!\!CH_2$, can give three monoenolic forms, five di-enolic forms, and the tri-enolic form $OH\cdot C\!\!<\!\!^{N:C(OH)}_{N\cdot C(OH)}\!\!>\!\!CH$, which would predominate in alkaline solution. The spectrum should, therefore, show distinct changes with p_H on account of $:NH\cdot CO\cdot \rightleftharpoons \cdot N:C(OH)\cdot$ tautomerism and the changes which are observed can be accounted for on this theory. Ultra-violet irradiation of (I) in unbuffered solution at p_H 4·6 gave marked progressive decrease in extinction. W. R. A.

Change of ultra-violet transparency of glass with temperature.—See B., 1940, 736.

Crystallo-chemical studies in spinel luminophors ; system magnesium orthotitanate–manganese.

E. TIEDE and E. VILLAIN (Ber., 1940, **73**, [B], 274—279).—Phosphors prepared by heating $2MgO + TiO_2$ with traces of Fe, Mn, Cu, Cr, Ag, Ni, Co, Re, Bi, Au, Zn, Nb, In, W, or U for 20 min. at 1200° have been examined. Only those containing Mn show luminescence in ultra-violet light, although the Cr phosphors luminesce in cathode rays. Emission from the Mn phosphors is confined to a narrow band of the spectrum with a max. at ~6550 A. (exciting light 3100—4000 A.). The optimum [Mn] is 0·5 mg. per g. of Mg_2TiO_4. Luminescence occurs only with Mg_2TiO_4 as base, as preps. from $MgO + 2TiO_2$ and $MgO + TiO_2$ give no effect with Mn. KCl is effectively used as a mineraliser in the heating process (1100°). The luminescence is improved by slow cooling and by heating the phosphors in O_2, but destroyed by heating in N_2. Relatively large amounts of Fe, Ni, and Cu also inhibit luminescence, and pressure has a slight inhibiting effect. Excitation occurs at −190° to 30°, but at >100° the intensity is diminished. The spinel structure of the phosphors is confirmed by X-ray powder diagrams. A. J. E. W.

Raman and infra-red spectra of α-quartz.

B. D. SAKSENA (Proc. Indian Acad. Sci., 1940, **12**, A, 93—139).—From known crystal data for α-quartz and the character table for the relevant point group, the symmetry modes of vibration of atoms in the unit cell, selection rules ; polarisation and intensity of lines, and their appearance in Raman and infra-red absorption spectra are deduced. Experimental results, using polarised and unpolarised excitation at different crystal orientations, are given and compared with recorded data and theoretical predictions. The sp. heat of α-quartz has been calc. from 23° to 808° K. from the spectroscopic analysis and is in complete agreement with experimental data. W. R. A.

Raman spectrum of aluminium bromide. E. J. ROSENBAUM (J. Chem. Physics, 1940, **8**, 643).—The Raman spectrum of liquid Al_2Br_6 at 100° consists of 5 strong and 4 weak lines. Possible models are discussed but no definite conclusions can be drawn from the data.   W. R. A.

Ionisation and dissociation of water vapour and ammonia by electron impact. M. M. MANN, A. HUSTRULID, and J. T. TATE (Physical Rev., 1940, [ii], **58**, 340—347).—From a mass-spectrometric study, data for the ions, intensities, appearance potentials, and processes are reported and discussed. The ionisation potential of H_2O is 13.0 ± 0.2 v., and of NH_3 10.5 ± 0.1 v. Ions observed in H_2O vapour are H_2O^+, OH^+, O^+, H^+, H_2^+, H_3O^+, O^-, and H^-. Ions observed in NH_3 are NH_3^+, NH_2^+, NH^+, N^+, H^+, NH_3^{++}, NH_2^-, and H^-.   N. M. B.

Energy states of valency electrons in some metals. I. 4_1. Nature of the electrode potential of zinc and hydrogen and the mechanism of catalytic action of metal surface (revisions). M. SATÔ (Sci. Rep. Tôhoku, 1940, **29**, 87—112).—Vals. of the normal electrode potentials of the (0001), $(10\bar{1}0)$, $(11\bar{2}0)$, $(10\bar{1}1)$, and $(11\bar{2}1)$ surfaces of the Zn crystal in H_2SO_4 and $ZnSO_4$ solutions are corr. (cf. A., 1937, I, 414). An explanation of the photoelectric properties of H_2 adsorbed on Mg (Cashman and Huxford, A., 1936, 3) is given.   O. D. S.

Conductivity of insulators and its interpretation. A. HIPPEL (J. Chem. Physics, 1940, **8**, 605—610; cf. A., 1939, I, 127).—The theory of the elementary processes involved in cryst. conductance is discussed with special reference to NaCl. Various models are considered and an attempt is made to characterise the "*F*" absorption band of the alkali halides.   W. R. A.

Zwitterion structures in organic molecules. (MISS) A. WEIZMANN (Trans. Faraday Soc., 1940, **36**, 978—982; cf. A., 1940, I, 148).—The following dipole moments are recorded : thioxanthone 5·4 D., xanthione 5·4 D., thioxanthione 5·2 D., *N*-methylacridone 3·5 D., *N*-methylthioacridone 5·2 D.,

4 : 4′-$NMe_2 \cdot C_6H_4 \cdot CH{:}CH \cdot C_6H_4 \cdot NO_2$ 8·3 D.,
4 : 4′-$NMe_2 \cdot C_6H_4 \cdot N{:}N \cdot C_6H_4 \cdot NO_2$ 8·1 D.,
4 : 4′-$OMe \cdot C_6H_4 \cdot CH{:}CH \cdot C_6H_4 \cdot NO_2$ 7·8 D.,
4 : 4′-$OMe \cdot C_6H_4 \cdot N{:}N \cdot C_6H_4 \cdot NO_2$ 6·5 D. These vals. are all > would be expected, and indicate resonance between the respective classical and zwitterion structures. In the heterocyclic compounds substitution of S for O increases the tendency to zwitterion formation.   F. L. U.

Dipole moments of amine oxides. E. P. LINTON (J. Amer. Chem. Soc., 1940, **62**, 1945—1948).—The following vals. of the dipole moments in C_6H_6 and dioxan, respectively, are given for oxides of : NMe_3 5·02, 5·04 ; $NPhMe_2$ 4·79, 4·85 ; C_5H_5N 4·24, 4·32 D. The large vals. indicate the presence of a $^+N{-}O^-$ semipolar bond to which a bond moment of 4·38 is attributed. Pyridine oxide resonates among several structures.   W. R. A.

Polarisabilities of bonds. I. K. G. DENBIGH (Trans. Faraday Soc., 1940, **36**, 936—948).—The mol. refraction of a large no. of org. compounds is shown to

be equal to the sum of the individual bond refractions, independently of the atoms present. Vals. for commonly occurring bonds are tabulated. Compounds with conjugated double bonds give abnormally high vals., the order of the single linking between double bonds being ~1·3. The mean polarisability of a bond can be resolved in directions along and at right angles to the bond; the longitudinal polarisability (b_l) is closely related to the length (r) and order (n) of the bond. In diat. hydrides b_l is $\propto r^3$, whilst in bonds not involving H $b_l \times 10^{25} = \sim n^2 r^6 + 6.0$ (r in A.).   F. L. U.

Structure and properties of glasses containing boron. M. L. HUGGINS (J. Amer. Chem. Soc., 1940, **62**, 2248).—The vol., n, and dispersion of those amounts of a SiO_2 glass which contain 1 g.-atom of O are additive functions of the ratio of the no. of atoms of " metallic " elements to the no. of atoms of O. Equations are given, but these do not hold for glasses containing B.   W. R. A.

Magneto-optic rotation : carbon disulphide and benzene solutions. C. E. WARING, H. HYMAN, and S. STEINGISER (J. Amer. Chem. Soc., 1940, **62**, 2028—2031).—A magneto-optic rotation method is described and used for determining the Verdet consts. of various solutions of C_6H_6, AcOH, $Pr^\beta CO_2H$, $Bu^\beta CO_2H$, and $Bu^\beta OH$ in CS_2. The possibility of determining intermol. structure from the Verdet const. is discussed.   W. R. A.

Determination of the proton-attracting properties of liquids. L. P. HAMMETT (J. Chem. Physics, 1940, **8**, 644).—The vals. for the ionisation const. of weak bases, deduced by Gordy and Stanford (A., 1940, I, 193) from the shift in the OD vibrational frequency of MeOD due to H bonding, are in good agreement with those obtained by Hammett *et al.* (A., 1936, 9) by entirely different methods.   W. R. A.

Calculation of the C:C linking strength and of certain resonance energies. D. WRINCH (Science, 1940, **92**, 79).—The C:C linking strengths in C_2H_4 and allene are <94·29 and 92·57 kg.-cal. per g.-mol., respectively. This modification in the C:C linking strength implies increased resonance energies for C_6H_6, $C_{10}H_8$, etc.; these are calc.   L. S. T.

Properties of monoethanolamine and its aqueous solutions. R. E. REITMEIER, V. SIVERTZ, and H. V. TARTAR (J. Amer. Chem. Soc., 1940, **62**, 1943—1944).—The following data for $NH_2 \cdot [CH_2]_2 \cdot OH$ are recorded : m.p. 10·5° ; b.p. $171.1 \pm 0.1°$; ρ and γ (from 25° to 80°) ; n_D^{20} 1·4539 ; parachor. γ for aq. solutions (0·001—0·10000 M.) are given.   W. R. A.

Quantum theory of X-ray reflexion and scattering. I. Geometric relations. (SIR) C. V. RAMAN and N. S. N. NATH (Proc. Indian Acad. Sci., 1940, **12, A**, 83—92).—From equations for the conservation of mass and momentum, the geometrical relations of lattice vibrations produced when X-rays fall on a crystal are deduced for the two cases in which the vibrations are (i) in the acoustic, (ii) in the optical, range of frequency.   W. R. A.

X-Ray examination of poly*iso*butylene. C. S. FULLER, C. J. FROSCH, and N. R. PAPE (J. Amer. Chem. Soc., 1940, **62**, 1905—1913).—Fibre patterns

of poly*iso*butylene (I) give a fibre period of 18.63 ± 0.05 A., in agreement with the val. of Brill and Halle (B., 1938, 413). 8 *iso*butylene units are contained in the repeating distance along the chain, supporting other evidence for a 1 : 3 arrangement of the Me group pairs and a helical configuration. Crystals of (I) appear to have an orthorhombic cell with a 6·94, b 11·96, and c 18.63 ± 0.05 A. (fibre axis). The effect of stretching on the X-ray pattern of high-mol. (I) is similar to that for natural rubber. W. R. A.

Structure of crystalline aliphatic compounds. X-Ray study of dicetyl ether. R. KOHLHAAS (Ber., 1940, **73**, [*B*], 189—200).—Dicetyl ether (I) of high purity, m.p. 55°, crystallises in rhombic plates, generally $\lessgtr 0.01$ mm. thick, with angles of 73·56° and $106.44 \pm 0.15°$. Rotating-crystal photographs give a unit cell (4 mols.; d 0.978 ± 0.009) with a 5·571, b 7·452 A. ($\pm 0.2\%$), c sin β 78·19 A. ($\pm 0.4\%$), β 63·07° ($\pm 0.5\%$); space-group, $P2_1/a$ (C_{2h}^5). A close similarity to cetyl palmitate (cf. A., 1938, I, 390), for which the same space-group is now preferred, is indicated, and confirmed by Schiebold–Sauter photographs. The puckered chains of the (I) mol. are collinear, and lie in a plane inclined at 20·92° to the b-axis. The chains are 0·874 A. in breadth, and lie $\lessgtr 4.03$ A. apart; the ends of successive chains are 3·22 A. apart. The distance between the C atoms is 1·539 A., and the valency angle 110·82°. These results are in good agreement with data for n-paraffins, showing that O and CH_2 are approx. equiv. structurally. Müller's rule (A., 1929, 869) is not verified in this and in other similar cases. A. J. E. W.

Lattice summations for hexagonal close-packed crystals. B. G. KANE and M. GOEPPERT-MAYER (J. Chem. Physics, 1940, **8**, 642).—Summations have been made over x–y planes of a hexagonal close-packed crystal with ideal axial ratio (1·633) for the inverse 6th, 8th, 10th, and 12th power of the distance between the particles. The lattice sums have approx. the same val. as for the face-centred cubic crystal. A direct comparison of the two types of crystal has been made. W. R. A.

Crystal structure of rhombohedral acetamide. F. SENTI and D. HARKER (J. Amer. Chem. Soc., 1940, **62**, 2008—2019).—NH_2Ac has space group C_{3v}^6,—$R3c$, a_0 11.44 ± 0.03, c_0 13.49 ± 0.03 A. referred to the smallest hexagonal unit cell of 18 mols. of NH_2Ac. The complete structure has been determined and it is concluded that (i) the length of the N–H–O bridge is 2.86 ± 0.05 A., (ii) the mol. is planar, (iii) the mol. exists in the keto-form, and (iv) the N–H bonds lie in the plane of the mol. Lengths of bonds and vals. of bond angles are given. W. R. A.

Hydrogen bridge models for globular proteins. M. L. HUGGINS (J. Chem. Physics, 1940, **8**, 598—600).—Two hypothetical types of structure, obtained by folding from basic patterns containing extended zig-zag polypeptide chains joined together by H bonds, are described. The idealised, undistorted 288-residue open-ended octahedral model has suitable horizontal dimensions for air-dried insulin but its vertical dimensions are rather too large. Structures

of this general nature are claimed to have many advantages over the cyclol models of Wrinch. W. R. A.

Hydrogen bond in protein structure. W. T. ASTBURY (Trans. Faraday Soc., 1940, **36**, 871—880).—The nature of the inter- and intra-mol. linkings in proteins is discussed. Available evidence is insufficient to decide for or against the presence of H bridges. F. L. U.

Formation of intermolecular hydrogen bonds. X-Ray evidence. J. M. ROBERTSON (Trans. Faraday Soc., 1940, **36**, 913—921).—Factors favouring the formation of H bonds are discussed and illustrated by reference to the cryst. structure of ice, phenols, carboxylic acids, $H_2C_2O_4$,$2H_2O$, and diketopiperazine as determined by X-ray methods. F. L. U.

Diffraction of X-rays by liquid argon. A. EISENSTEIN and N. S. GINGRICH (Physical Rev., 1940, [ii], **58**, 307—309).—Microphotometer records of the X-ray diffraction pattern of liquid A obtained with crystal-reflected Mo $K\alpha$ radiation show peaks at sin $\theta/\lambda = 0.154$ (very strong), 0·280 (medium), and 0·415 (weak). A Fourier analysis of the diffraction pattern gives an at. distribution curve showing approx. 7 atoms at 3·90 A. and 5 atoms at ~5·05 A. A third broad peak occurs at over 7 A. Results indicate that the distribution of atoms in liquid A does not follow closely that in cryst. A, since in the crystal there are 12 nearest neighbours. N. M. B.

Stable relative orientation of groups connected by a carbon–carbon single linking. V. SCHOMAKER and D. P. STEVENSON (J. Chem. Physics, 1940, **8**, 637—638).—Polemical against Langseth et al. (A., 1940, I, 282) particularly with regard to the structures proposed by these authors for liquid *cyclo*hexane, $(CHCl_2)_2$, and ethylene deuterobromide. W. R. A.

Molecular structures of dimethylchloroamine and methyldichloroamine. D. P. STEVENSON and V. SCHOMAKER (J. Amer. Chem. Soc., 1940, **62**, 1913—1916).—Electron diffraction data on NMe_2Cl and $NMeCl_2$ indicate that the N—Cl distances are 0·08 and 0·05 A. >1·69 A., the sum of the covalent radii. This supports previous evidence on the bond lengths between highly electro-negative atoms. Vals. of bond distances and bond angles are given. W. R. A.

Radial distribution method in electron diffraction. J. WALTER and J. Y. BEACH (J. Chem. Physics, 1940, **8**, 601—604).—Theoretical. A new radial distribution function method for interpreting electron diffraction photographs of gas mols. is discussed and tested for a diat. mol., a linear and a non-linear triat. mol., and CCl_4. W. R. A.

Secondary electron emission. (A) Temperature effects. (B) Order and disorder effects. D. E. WOOLDRIDGE. (B) Order and disorder effects. D. E. WOOLDRIDGE and C. D. HARTMAN (Physical Rev., 1940, [ii], **58**, 316—321, 381; cf. A., 1939, I, 590).—(A) Measurements of temp. effects on the emission of secondary electrons from Fe, Ni, Co, and Mo show abrupt changes of 1—2% accompanying the α–γ transition of Fe, ~0·4% for the hexagonal to face-centred cubic transformation of Co, and <0·3% for the magnetic trans-

formation of Ni. The temp. coeff. of secondary emission for Ni, Co, and Mo is $\leqslant$ the vol. coeff. of expansion of the metal. Results support the view that the secondary electrons are scattered or "absorbed" by an excitation process similar to that by which they are produced.

(B) The curve plotted from an investigation of Cu_3Au over the order–disorder temp. range is inconclusive, and indicates that the secondary emission in the two states differs by $\not>1$ or 2%.   N. M. B.

Longitudinal magneto-resistance effect on single crystals of iron. Longitudinal magneto-resistance effect at low temperatures of single crystals of iron. Y. SHIRAKAWA (Sci. Rep. Tôhoku, 1940, **29**, 132—151, 152—161).—I. The intensity of magnetisation and the change in electrical resistance of single crystals of Fe of known orientation have been measured in longitudinal magnetic fields up to 1400 oersteds. The magneto-resistance effect increases linearly with field until it reaches saturation sharply at a certain field strength. The effect is strongly anisotropic. The saturation vals. for the [100], [110], and [111] axes are 0.00_3, 0.36, and 0.48%, respectively.

II. The magneto-resistance curves of single-crystal Fe at 0°, −95°, −195° in fields up to 1400 oersteds are similar to each other and to those obtained at room temp. $\Delta R/R$ increases with decreasing temp.   O. D. S.

Light figures in single crystals of nickel and copper. M. YAMAMOTO (Sci. Rep. Tôhoku, 1940, **29**, 113—131).—Single crystals of Cu and Ni have been prepared by slow solidification. Light figures produced by reflexion of a narrow pencil of light from surfaces etched with various acid and salt solutions have been investigated and correlated with the crystal structure of the surfaces.   O. D. S.

Elasticity of crystals. F. BIRCH and D. BANCROFT (J. Chem. Physics, 1940, **8**, 641—642).—The rigidity of polycryst. Al (m.p. 663°) between 0° and 650° has been measured by a dynamical method. The ratios of resonant frequencies at even temp. to the frequency at 0° and the corresponding ratios of rigidity are tabulated. No conclusive evidence has been obtained on whether rigidity vanishes at the m.p. or retains a finite small val.   W. R. A.

Internal friction of single metal crystals. T. A. READ (Physical Rev., 1940, [ii], **58**, 371—380).— The internal friction of cryst. Cu, Sn, Pb, and Zn has been measured by the composite piezoelectric oscillator method. It is found that the decrement of an unannealed crystal may be as large as that of the polycryst. material, but is reduced by annealing to a val. of $\sim 10^{-4}$—10^{-5}, and that both Young's modulus and the decrement vary with the vibrational strain amplitude at strain amplitudes as low as 10^{-6}. For Zn crystals the dependence of the elastic modulus and internal friction on previous history of the specimen, vibration frequency and amplitude, and on the orientation of the vibration axis to the crystal slip planes has been investigated; the results suggest that the mechanism involved is a propagated "dislocation" of the sort proposed to account for macroscopic plastic flow.   N. M. B.

Titanium. XV. Polymorphous structures of titanium dioxide. A. V. PAMFILOV and E. G. IVANTSCHEVA (J. Gen. Chem. Russ., 1940, **10**, 154—157).—The existence of TiO_2 having a brookite structure is not confirmed.   R. T.

Dielectric strength of liquid and solid benzene. W. BÄHRE (Arch. Elektrotech., 1937, **31**, 141—165; Chem. Zentr., 1937, i, 4627—4628).—The effect of wave-form, impurities (particularly H_2O and air), and temp. on the dielectric strength (X) of liquid C_6H_6 is examined. The max. observed val. of X is 1870 kv. per cm.; with undried C_6H_6, not de-aërated, $X = 1330$ kv. per cm. ($\pm 10\%$) at atm. pressure and room temp., with a 0·7-mm. gap. The results are in general agreement with Koppelmann's theory (A., 1936, 665). For solid C_6H_6 X is only ~ 150 kv. per cm., and depends largely on crystal size.   A. J. E. W.

Elasto-resistance change of nickel, iron, and some nickel–iron alloys. N. YAMANAKA (Sci. Rep. Tôhoku, 1940, **29**, 36—68).—The change in electrical resistance of Ni, Fe, and nine Ni–Fe alloys (from 15 to 90% Ni) produced by tension up to the elastic limit in the presence of magnetic field up to 439 oersteds has been measured. The resistance change of magnetic origin increases or decreases with tension according as the magnetic elongation is positive or negative. For small tensions the resistance change is in accordance with the domain theory of ferromagnetism.   O. D. S.

Superconductors. (A) Phenomenological theory. (B) Complete data and boundary conditions. E. COOK (Physical Rev., 1940, [ii], **58**, 357—361, 361—364).—Mathematical. (A) A rigorous theory leading to results identical with those of London is developed.

(B) A set of data and boundary conditions, mathematically complete and physically significant, for the London theory is derived.   N. M. B.

Diamagnetism and the hydrogen bond. W. R. ANGUS and W. K. HILL (Trans. Faraday Soc., 1940, **36**, 923—927).—The diamagnetic susceptibility of BzOH, o-, m-, and p-$OH \cdot C_6H_4 \cdot CO_2H$, and p-$OH \cdot C_6H_4 \cdot NO_2$ dissolved in liquids of different proton-attracting powers was measured. Preliminary results indicate that the χ for H-bonded structures involving ring formation is $<$ that calc. by an additive law, and diminishes with increasing solute concn. The reverse is true when the H-bonding occurs between solute and solvent.   F. L. U.

Specific heats of copper nitride, niobium nitride, and sodium azide, and the atomic heat of nitrogen. S. SATOH and T. SOGABE (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 943—950).—From measurements of the sp. heat of Cu_3N (0—99·6°), NbN (0—99·6° and 0—300°), and NaN_3 (0—99·6°) vals. of the at. heat of N have been deduced as 3·94, 4·44, and 4·10, respectively, in good agreement with previous vals. (e.g., A., 1940, I, 201).   W. R. A.

Gaseous heat capacities. II, III. G. B. KISTIAKOWSKY and W. W. RICE (J. Chem. Physics, 1940, **8**, 616—618, 618—622; cf. A., 1939, I, 362).— II. An extension of previous work to allene, CH:CMe, cyclopropane, propylene, and C_3H_8.

III. The heat capacities of Me_2O, $(CH_2)_2O$, $(CMe_2)_2$, cis- and trans-Δ^β-butene are discussed.   W. R. A.

Heat capacity and entropy, heats of fusion and vaporisation, and the vapour pressure of n-butane. J. G. ASTON and G. H. MESSERLY (J. Amer. Chem. Soc., 1940, 62, 1917—1923).—C_p vals. for n-C_4H_{10} have been determined from $12.73°$ to $272.66°$ K. The v.p. is given by $\log_{10} p$ (mm.) $= -2352.900/T + 16.49230 \log_{10} T + 0.01111869T + 48.64763$. The following consts. have been determined : transition temp., $-165.60°$; m.p. $-138.29°$; b.p. $-0.50°$ ($272.66 \pm 0.03°$ K.); heat of transition 494.0 ± 1, of fusion 1113.7 ± 1, and of vaporisation 5351 ± 15 g.-cal. per mol.; $S_{272.66°}$ K. (ideal gas at 1 atm.) $= 72.05 \pm 0.2$; $S_{298.16°}$ K. (ideal gas at 1 atm.) $= 74.0$; $S_{298.16°}$ K. (liquid) $= 55.2$ g.-cal. per degree per mol. Using a val. of 3300 g.-cal. per mol. for Me group potential, the experimental val. of S, and the C-chain vibration frequency of Kohlrausch and Koppe (A., 1934, 942), the restricting potential or torsional frequency associated with the restricted rotation of the two Et about the middle C–C linking has been evaluated as $\sim$30,000 g.-cal. per mol. Vals. of thermodynamic functions are derived for temp. between $272.7°$ and $1300°$ K.   W. R. A.

Heat capacity and entropy, heats of fusion and vaporisation, and the vapour pressure of iso-butane. J. G. ASTON, R. M. KENNEDY, and S. C. SCHUMANN (J. Amer. Chem. Soc., 1940, 62, 2059—2063).—C_p vals. for iso-C_4H_{10} have been determined from $12.53°$ to $261.44°$ K. The v.p. is given by $\log_{10} p$ (mm.) $= -1716 - 687/T - 6.38879 \log_{10} T + 0.0024132T + 24.260325$. The following consts. have been determined : m.p. $-159.42°$ ($113.74 \pm 0.5°$ K.); b.p. $-11.72°$ ($261.44 \pm 0.02°$ K.); heat of fusion 1085.4 ± 0.5 and of vaporisation 5089.6 ± 8 g.-cal. per mol. From thermal data, $S_{298.16°}$ K. (ideal gas at 1 atm.) $= 70.43 \pm 0.15$, $S_{298.16°}$ K. (saturated liquid) $= 52.09 \pm 0.10$ g.-cal. per degree per mol. These vals. are $>$ that deduced from spectroscopic and mol. data by, at the b.p., 5.08 entropy units, which is assumed to represent the potential restricting internal rotation of the Me groups (3870 g.-cal.).   W. R. A.

Thermodynamic properties of methyl cyanide and methyl isocyanide. R. H. EWELL and J. F. BOURLAND (J. Chem. Physics, 1940, 8, 635—636).—By combining the electron diffraction data of Brockway (A., 1937, I, 119) and the mol. spectroscopic data of Badger and Bauer (A., 1937, I, 165) vals. of $-(G^0 - U_0^0)/T$, $(H^0 - U_0^0)/T$, S^0, and C_p^0 for the ideal gas state of MeCN and MeNC have been calc. from $273°$ to $773°$ K.   W. R. A.

Thermodynamics of irreversible processes. I. Simple fluid. C. ECKART (Physical Rev., 1940, [ii], 58, 267—269; cf. infra).—Mathematical. The rate of increase of entropy of a simple heat-conducting viscous fluid is investigated in detail. It is shown that if Kelvin's hypothesis on abs. temp. is adopted and the usual law of viscosity assumed the requirements of the second law are satisfied.   N. M. B.

X-Ray investigation of the phase transitions of sodium palmitate. F. G. CHESLEY (J. Chem.

Physics, 1940, 8, 643).—Investigation of phase transitions of Na palmitate by a temp.-controlled X-ray powder method has revealed the existence of seven phases and six transitions between room temp. and 290° (isotropic liquid). The transition temp. are in good agreement with those found dilatometrically by Vold and Vold (cf. B., 1939, 743) and, in addition, a new transition temp. at 67° is recorded.   W. R. A.

Transformations of carbamide of a higher order. V. A. SOKOLOV (J. Gen. Chem. Russ., 1940, 10, 165—171).—The coeff. of expansion of $CO(NH_2)_2$ is anomalously high at $-2°$ and at 33°, indicating transformations of a higher order at these temp.   R. T.

Joule–Thomson effect in mixtures of helium and argon. J. R. ROEBUCK and H. OSTERBERG (J. Chem. Physics, 1940, 8, 627—635).—The Joule–Thomson effect has been measured in four mixtures of He and A and, from isenthalpic curves, the Joule–Thomson coeff. has been calc. for various temp., pressures, and composition.   W. R. A.

Thermodynamics of irreversible processes. II. Fluid mixtures. C. ECKART (Physical Rev., 1940, [ii], 58, 269—275; cf. supra).—Mathematical. The possibility of constructing a systematic theory of irreversible processes is surveyed in general terms and for a mixture of ideal gases.   N. M. B.

Partial pressure of hydrogen chloride from its solutions in monohalogenobenzenes at 25°. S. J. O'BRIEN and J. B. BYRNE (J. Amer. Chem. Soc., 1940, 62, 2063—2065).—Measurements of the partial v.p. of HCl from its solutions in PhF, PhCl, PhBr, and PhI over the concn. ranges 0.02—0.12, 0.008—0.103, 0.013—0.069, and 0.006—0.04M., respectively, show that Henry's law is obeyed but that there is positive deviation from Raoult's law.   W. R. A.

Vapour pressure of glycerin solutions at 20°. D. W. GROVER and J. M. NICOL (J.S.C.I., 1940, 59, 175—177).—The v.p. of glycerin (I) solutions from 25% to 92% by wt. are measured by determining the dew point of air maintained in equilibrium with the solutions. By means of Dühring's rule it is proved that the relative v.p. of (I) solutions is substantially independent of temp. over the range 0—70°, a fact which enables the figures of various workers to be compared. The relative v.p. obtained at 20° are in good agreement with the majority of the published data, but not with one table in the International Critical Tables, which must therefore be considered to be in error.

Vapour pressure of glycerin. (A) E. C. CRAVEN. (B) D. W. GROVER (Chem. and Ind., 1940, 690).—(A) The assumption made by Grover and Nicol (preceding abstract), that the dew point method gives only the partial pressure of H_2O, is criticised.

(B) Reasons are given for the belief that in practice the dew deposit from glycerin solutions consists of H_2O only, at least for concns. $>90\%$.   F. L. U.

Trimethylcarbinol as a cryoscopic solvent. F. H. GETMAN (J. Amer. Chem. Soc., 1940, 62, 2179—2180).—The cryoscopic const. of $Bu^\gamma OH$ has been determined from f.p. measurements on 30 sub-

stances and is 8·37. Unless precautions are taken in the prep. and preservation of Bu$^\gamma$OH results are vitiated by association effects.   W. R. A.

Theory of diffusion, viscosity, and electrolytic conduction. S. KANEKO (Bull. Chem. Soc. Japan, 1940, **15**, 276—280).—By combining Horiuti's theory of reaction velocity with Einstein's theory of diffusion, certain relationships between χ, η, and K (diffusion coeff.) are obtained.   F. J. G.

Carbamide. I. Hygroscopicity of soluble substances. Vapour pressures of saturated salt solutions. W. SAKAI (J. Soc. Chem. Ind. Japan, 1940, **43**, 104—106B).—Solids become hygroscopic when the humidity is $>$ that over their saturated solution at the given abs. temp. T. The v.p. of saturated solutions is expressed by $\log p = -D/T + E \log T + FT + i$, where D, E, F, and i are consts. The crit. humidity π above which solids become hygroscopic is $\pi = 100 p/p_0$, where p_0 is the v.p. of the pure solvent at temp. T. Calc. vals. of π agree with experimental for NaCl, K_2SO_4, and KNO_3, at 291—295° K.   R. T.

Silicate glasses. M. L. HUGGINS (J. Chem. Physics, 1940, **8**, 641).—Vols. (V_o), n, and dispersions of well-annealed silicate glasses are simple additive functions of the compositions, when calc. for the quantity of glass containing one g.-atom of O and when the compositions are expressed as the no. of atoms (N_m) of the " metallic " elements per O. The plot of $V_{o\mathrm{si}}$ against N_{si} for Na_2O–SiO_2 glasses is given and the different slopes are discussed.
                    W. R. A.

Susceptibility of mixed crystals to chemical attack. R. SCHENCK (Festschr. Tech. Hochschule Breslau, 1910—1935, 432—435; Chem. Zentr., 1937, i, 4191).—By utilising the fact that CuO or Cu_2O evolves O_2 when heated with Au, Pt, or Pd (M), with formation of Cu-M mixed crystals, the equilibrium relationships in the system Au–Cu–O are examined. The distribution coeffs. of Cu between Au, Pt, and Pd are deduced from the [Cu] in the Cu-M alloys. The forces which tend to alloy the Cu with M are sufficiently strong to exceed the chemical affinity of Cu and O. The reactivity of the Cu towards external influences is reduced by lattice forces, and may be completely suppressed even by free diffusion into the M lattice.   A. J. E. W.

Factors affecting the formation of 3/2 electron compounds in alloys of copper, silver, and gold. W. HUME-ROTHERY, P. W. REYNOLDS, and G. V. RAYNOR (J. Inst. Metals, 1940, **66**, 191—207).—In many alloys of Cu, Ag, and Au with elements of the B-sub-groups of the periodic system the phase next to the α solid solution has a composition near to that required by an electron concn. of $\sim$1·5, i.e., is a 3/2 electron compound. The structures of these phases are (a) body-centred cubic disordered β or ordered β', (b) close-packed hexagonal ζ or ζ', or (c) of the β-Mn type (μ). The phases are formed only when the difference between the at. diameters of solvent and solute, i.e., the " size factor," is favourable. From a detailed examination of the various equilibrium diagrams it appears that increasing valency favours the

ζ or μ structure at the expense of the β or β' structures, increasing temp. and size factor favour the β structure, and increasing size factor moves the composition in the direction of lower electron concn. and narrows the range of composition of the phases in terms of electron concn. Au alloys have the greatest and Cu the smallest tendency to form ordered β' structures. As the solvent and solute metals differ to an increasing extent in their electrochemical properties another factor (electrochemical factor) comes into play; in alloys with the more electropositive metals Cu, Ag, and Au are the electronegative members of the alloys and the electrochemical factors are in the order Au $>$ Ag $>$ Au, whereas in alloys with the electronegative elements these factors are in the reverse order and the Cu, Ag, and Au are the electropositive members of the alloys. With increasing electrochemical factor the tendency to form β' structures with long-range order increases, and may be such that the β' solidus and liquidus curves rise to a max., e.g., in Au–Mg alloys. The shape of the Cu–Be equilibrium diagram is explained on the basis of the effect of the development of long-range order. Frequently when the % of solute is high the diagrams begin to acquire the characteristics expected in ordered structures although X-rays show that long-range order does not exist; it is suggested that a short-range order may be present and it is shown that this would account for the shapes of parts of the diagrams and for the limiting compositions to which some of the phase boundaries approach.   A. R. P.

Constitution and structure of alloys of intermediate composition in the systems copper–indium, copper–aluminium, copper–germanium, silver–aluminium, and silver–germanium. W. HUME-ROTHERY, G. V. RAYNOR, P. W. REYNOLDS, and H. K. PACKER (J. Inst. Metals, 1940, **66**, 209—239; cf. preceding abstract).—In the Cu–In system the $\alpha +$ liquid $\rightleftharpoons \beta$ peritectic temp. is 710°, the liquid $\rightleftharpoons \beta + \gamma$ eutectic temp. 676°, and the $\beta \rightleftharpoons \alpha + \delta$ eutectoid temp. 574°; Cu dissolves 10·9 at.-% of In at 574° and the eutectoid composition is In 20·15 at.-%. In the Cu–Al system the $\beta \rightleftharpoons \alpha + \delta$ eutectoid is at Al 24 at.-%, 560—565°; under equilibrium conditions there is no evidence of the existence of any modification of the β phase, those modifications previously reported being metastable intermediate forms. In the Cu–Ge system the peritectic horizontal, $\alpha +$ liquid $\rightleftharpoons \zeta$, is at 822·5° and starts at Ge $\sim$12 at.-%; the lower peritectic horizontal, $\zeta +$ liquid $\rightleftharpoons \gamma$, is at 743° and starts at Ge 18·3 at.-%, whilst the $\zeta + \gamma/\zeta + \varepsilon$ horizontal is at 540° and starts at Ge 18·2 at.-%. In the Ag–Al system the $\alpha + \beta \rightleftharpoons \zeta$ transformation occurs at 610°, the $\beta \rightleftharpoons \beta + \zeta$ transformation at a min. of 604·5° with Al 24·5 at.-%, and the $\alpha + \zeta \rightleftharpoons \mu$ transformation at 448°, Al 20·65—23·8 at.-%. The range of composition of μ broadens considerably with fall in temp. and the areas of the $\alpha + \mu$ and $\mu + \zeta$ phase fields also extend rapidly. No evidence was found of the existence of a 3/2 electron compound in the Ag–Ge system; the eutectic temp. in this system is placed at 651°.   A. R. P.

Temperature-dependence of Young's modulus of β-brass single crystals. J. S. RINEHART

(Physical Rev., 1940, [ii], **58**, 365—371 ; cf. Siegel, A., 1940, I, 250).—Young's modulus, E, of 7 single crystals of β-brass was measured by the composite piezo-electric oscillator method as a function of temp. for 25—505° in order to study order–disorder phenomena. $1/E$ is linearly related to the orientation function at all temp. The max. and min. vals of $1/E_{[100]}$ and $1/E_{[111]}$ are 3·881 and 0·475 × 10^{-12} at room temp. and 4·970 and 0·583 × 10^{-12} sq. cm. per dyne at the crit. temp. 468°. The elastic anisotropy $E_{[111]}/E_{[100]}$ is 8·2 at room temp., decreasing to a min. 7·2 at 300°, and increasing to 8·6 at the crit. temp. Plots of $1/E$ for the directions [100], [110], and [111] show that the effect of disorder is felt mainly in the first two directions, whilst in the third the elasticity shows an approx. linear increase with rising temp. Before disorder sets in, the elasticity in the [100] direction decreases with rising temp., contrary to the usual behaviour of elastic materials. N. M. B.

Measurement of gyromagnetic effect of manganese–antimony and iron–selenium alloys. F. GALAVICS (Helv. Phys. Acta, 1939, **12**, 581—608).—The gyromagnetic effect of Mn–Sb (Mn 48·6%, Sb 50·0%, Fe 1·4%) and Fe–Se alloys in powder form has been investigated by the resonance method of Coeterier (*ibid.*, 1932, **3**, 217). For the Mn–Sb alloy the Landé splitting factor $g = 2$ within experimental error. Vals. of g for the Fe–Se alloy are uncertain owing to the high permanent moment of the substance and vary between 0·35 and 0·88. O. D. S.

Order–disorder transformations in ternary alloys. T. HIRONE and S. MATUDA (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 931—942).—The Williams statistical theory of order–disorder transformations in binary alloys is extended to ternary alloys, and vals. of sp. heat, entropy, and free energy of an alloy of the Cu_2MnAl type have been calc. W. R. A.

Critical solution temperatures and aniline points of some butane hydrocarbons. C. G. LUDEMAN (Ind. Eng. Chem. [Anal.], 1940, **12**, 446—448).—Apparatus is described and procedure detailed for determining the miscibility temp. for mixtures of volatile hydrocarbons with NH_2Ph. The NH_2Ph points of n- and iso-C_4H_{10} and iso-C_4H_8 are 83·1°, 107·6°, and 14·9°, respectively, and the crit. solution temp. 84·1°, 109·0°, and 15·8°. J. D. R.

Effect of certain factors on the relation between chemical composition and solubility (m.p.). V. P. SCHISCHOKIN (Ann. Sect. Anal. Phys.-Chim., 1940, **12**, 213—227).—A review. R. T.

Aqueous solubilities of aliphatic ketones. P. M. GINNINGS, D. PLONK, and E. CARTER (J. Amer. Chem. Soc., 1940, **62**, 1923—1924).—The aq. solubilities of 12 aliphatic ketones have been measured at 20°, 25°, and 30°. The smaller is mol. size, the greater is solubility. Among isomerides, the most compact is the most sol. and movement of the CO group towards the centre of the chain reduces the solubility. W. R. A.

Lecture demonstration of mixed solvent action. H. K. SEN and S. R. PALIT (Current Sci., 1940, **9**, 333—334).—Experiments are described. J. L. D.

Heats of adsorption of gases on iron synthetic ammonia catalysts at low temperatures. R. A. BEEBE and N. P. STEVENS (J. Amer. Chem. Soc., 1940, **62**, 2134—2140).—The differential heats of adsorption of several gases have been measured between 0° and —183° using a doubly-promoted Fe (1·59% K_2O, 1·3% Al_2O_3) and a pure Fe catalyst. Chemisorbed gas has been determined and attempts have been made to differentiate between van der Waals adsorption and chemisorption. Measurements indicate that adsorption of N_2 and A at —183° is entirely van der Waals ; H_2 at —183°, and CO at —183°, —78°, and 0° partly chemisorption ; CO_2 at —78° is chemisorbed on the promoted but van der Waals on the pure Fe catalyst. O_2 measurements at —183° indicate complex adsorption with possible formation of Fe oxide. W. R. A.

Sorption of gases and vapours by titania gel. VII. Sorption and desorption equilibria of organic vapours and a critical condition for capillary condensation phenomena. I. HIGUTI (Bull. Inst. Phys. Chem. Res. Japan, 1940, **17**, 951—975 ; cf. A., 1939, I, 561).—Sorption and desorption isotherms at 0°, 10°, 20°, and 30° have been obtained for vapours of MeOH, EtOH, Pr^aOH, $Pr^\beta OH$, PhCl, PhMe, n-C_6H_{14}, n-C_7H_{16}, $COMe_2$, and EtOAc by TiO_2 gel. The isotherms consist of two parts ; in the lower relative pressure range the curve represents adsorption of vapour on the gel surface, whilst at higher relative pressures capillary condensation of adsorbates in the pores of the gel occurs. W. R. A.

Sorptive and catalytic properties of active manganese dioxide, with reference to vapours and gases. III. Formation at active manganese dioxide of oxides of nitrogen. E. V. ALEXEEVSKI and V. B. ALESKOVSKI (J. Gen. Chem. Russ., 1940, **10**, 137—145 ; cf. A., 1938, I, 88).—Evolution of oxides of N observed when air, O_2, or other gas is passed over active MnO_2 is ascribed to desorption of N_2O_3, adsorbed from the air during prep. of the MnO_2. Adsorbed oxides of N may be completely eliminated by heating the MnO_2 at 300°. R. T.

Application of Polanyi theory to bound water. I. Calculation of adsorption potential from vapour pressure of bound water. R. E. NEUMANN and O. V. NEUMANN. **II. Effect of nature of dissolved substances on water bound from solutions.** O. V. NEUMANN and R. E. NEUMANN (Kolloid. Shurn., 1938, **4**, 3—11, 13—18).—I. The apparent adsorption of H_2O from 0·02—0·3M. solutions of EtOH by cotton wadding has been measured at 0—53°, and the results are examined in terms of the atm. theory of adsorption. The amount (x) of H_2O bound from a solution of given concn. falls linearly with rise of temp., except for the more conc. solutions. The vals. of the adsorption potential, ϵ, calc. from the v.p. of the solution, plotted against x all fall on the same curve, irrespective of the temp.

II. At low concns. the amounts of H_2O fixed from solutions of $Bu^\beta OH$, glucose, and sucrose of the same concn. are not equal, but with increasing concn. they approach and ultimately coincide. It is deduced that

at the higher concns. the more loosely held H_2O (I) has been removed by osmotic forces, and only oriented H_2O mols. remain; (I) may be supposed to dissolve some solute. The ϵ–x curve is not influenced by the temp., but varies with the solute.   R. C.

Adsorption of malachite-green by clays and allied minerals. V. L. Bosazza (Nature, 1940, **146**, 334).—Kaolinite (I), anauxite, montmorillonite, pyrophyllite, talc, and beidellite are stained different shades of green or blue by the dye. The amounts of dye absorbed and the degrees of fastness differ with the different minerals. Washing with H_2O, acid, or alkali fails to remove the adsorbed dye from (I).
          L. S. T.

Adsorption of fluorides by enamel, dentine, bone, and hydroxyapatite.—See A., 1940, III, 755.

Ageing and coprecipitation. XXXII. Adsorptive properties and the determination of the specific surface of lead chromate. I. M. Kolthoff and F. T. Eggertsen (J. Amer. Chem. Soc., 1940, **62**, 2125—2131; cf. A., 1940, I, 108).—The determination of the sp. surface of fresh and aged ppts. of $PbCrO_4$ by means of wool-violet (I) and Th-B is described. With (I) equiv. amounts of dye and Pb are removed from the solution, and on the saturated surface one (I) ion is adsorbed per 2 mols. of $PbCrO_4$. $Pb(OAc)_2$ is adsorbed unimolecularly from a dil. solution in 95% EtOH on the surface of $PbCrO_4$. Radioactive methods give new procedures for the determination of surface area.   W. R. A.

(A) **Application of surface tension to physicochemical analysis of rational systems.** N. A. Trifonov and G. K. Alexandrov. (B) **Surface tension isotherm of binary liquid systems.** N. A. Trifonov. (C) **Surface tension of the rational systems aniline-allylthiocarbimide and acetic anhydride–water, in connexion with their other properties.** N. A. Trifonov and A. T. Chalezova. (D) **Surface tension of irrational binary liquid systems.** N. A. Trifonov and R. V. Mertzlin (Ann. Sect. Anal. Phys.-Chim., 1940, **12**, 85—101, 103—121, 123—137, 139—155).—(A) Theoretical. Possible types of surface tension (σ)–composition curves of rational binary systems are discussed.

(B) The literature is reviewed, and the forms of σ–composition diagrams of systems of the type A + B → AB, where AB is an undissociated or slightly dissociated compound, are discussed.

(C) The σ–composition curves of the system $NH_2Ph\cdot CHMe{:}CH\cdot NCS$ at 100° and 125° consist of two ascending branches intersecting at 50 mol.-%, corresponding with $NHPh\cdot CS\cdot NH\cdot CH{:}CHMe$. The corresponding diagram for Ac_2O–H_2O (25°, 50°, and 75°) consists of two descending branches, intersecting at a min. at 50 mol.-%, corresponding with formation of AcOH.

(D) Possible forms of σ–composition curves of systems of the type A + B → AB, where AB is a highly dissociated compound, are discussed, and are illustrated by the systems $EtOAc$–$SnCl_4$ (20°, 40°, 60°), PhOH–piperidine (25°, 50°) and –NH_2Ph (25°, 50°, 75°, 100°), C_5H_5N–AcOH (0°, 25°, 50°, 75°), and chloral–H_2O (50°, 75°).   R. T.

Measurement of linear tension at the boundary liquid–liquid–air. R. S. Bradley (Trans. Faraday Soc., 1940, **36**, 999—1003).—An equation is derived giving a relation between the linear tension f at a liquid–liquid–air boundary and the diameter, thickness at centre, and diameter corresponding with max. thickness, of lenses of one liquid floating on another. The equation is applied to calculate f from measurements of the dimensions of lenses of oleic acid on aq. solutions at various p_H vals., and of lenses formed from conjugate solutions of PhOH and H_2O. Substantially the same vals. of f are obtained by measuring the period of oscillation of a deformed lens. The equation can also be used to calculate the spreading pressure of the lighter liquid, and the interfacial tension of the liquid phases if their surface tensions are known.   F. L. U.

Capillary behaviour in porous solids. M. C. Leverett (Amer. Inst. Min. Met. Eng., 1940, Tech. Paper 1223, 17 pp.; Petrol. Tech., **3**, No. 3).—The equilibrium distribution of two immiscible fluids of different densities in a porous solid is discussed theoretically on the basis of the formation of inter-fluid interfaces the curvature of which depends on the size of the inter-grain spaces and the proportions of the fluids present. An apparatus for determining the capillary equilibrium of fluids in unconsolidated sand is described. It is shown that the extent of the two-fluid interfacial area can be deduced thermodynamically from the curvature–saturation relation. The theory is applied to the flow of mixtures of two or three immiscible fluids (e.g., air, oil, and H_2O) in porous sand. The existence of a boundary effect at the outflow face of the sand column, retarding the egress of oil and H_2O, is emphasised.   J. W. S.

Monolayers of esters and chlorinated derivatives possibly useful as lubricating addition agents. G. L. Clark and J. V. Robinson (J. Amer. Chem. Soc., 1940, **62**, 1948—1951).—The areas per mol. at zero compression and the collapse pressures have been determined for monolayers (on H_2O) of Me stearate (I), α-chloro- and dichloro-stearate, oleate, ricinoleate, and chlororicinoleate, ethylene glycol distearate (II) and ricinoleate, and $(C_6H_4Me)_3PO_4$, and (on Cl_2–H_2O) of Me oleate and ricinoleate. Films were built up by the Blodgett–Langmuir method. (I) and (II) give solid condensed films, whilst the others form liquid films. An improved film balance is described.   W. R. A.

Molecular interactions at oil–water interfaces. III. Interfacial tension measurements. A. E. Alexander and J. H. Schulman (Trans. Faraday Soc., 1940, **36**, 960—964; cf. A., 1940, I, 320).—The lowering of γ between aq. Na dodecyl sulphate and C_6H_6 solutions of oil-sol. emulsifiers is in the order cholesterol = octadecyl alcohol = elaidyl alcohol > oleyl alcohol > cholesteryl myristate, agreeing with the order of stability of the corresponding oil-in-H_2O emulsions. Addition of Na_2SO_4 or of $(NaPO_3)_3$ to aq. $C_{17}H_{35}\cdot NH_2,HCl$ in contact with C_6H_6 causes a rapid rise in γ followed by a fall to < the initial val., while the originally liquid interfacial film becomes solid.   F. L. U.

Study of amorphous films by electron diffraction. S. YAMAGUCHI (Nature, 1940, **146**, 333). Hygroscopic substances such as $ZnCl_2$ give electron diffraction haloes as well as rings in a high vac. In the $ZnCl_2$-H_2O films that can be produced on a cleaned Pt wire, the rings are due to crystals of $ZnCl_2$, and the haloes to a saturated solution of $ZnCl_2$. L. S. T.

Gelation phenomena in wheat-flour films. J. D. HAMILTON (Canad. J. Res., 1940, **18**, **B**, 194—202).—The behaviour of wheat-flour protein mono-layers on H_2O, produced by spreading from foam, has been investigated, and empirical equations are derived to represent the force–area relationships. The results indicate that the protein forms a gel when the film area is decreased, and that degelation occurs when the area is increased again. It is suggested that, at the point of gelation, the protein micelles form a close-packed film, the residues being outside the surface in such a manner that the binding force between the film micelles and the aq. substrate is normal to the surface. Further compression of the film is supposed to cause the film, together with a layer of substrate, to curl into logarithmic spirals, which constitute the gel structure. J. W. S.

Evaporation of water through multimolecular films. A. R. DOCKING, E. HEYMANN, L. F. KERLEY, and K. N. MORTENSEN (Nature, 1940, **146**, 265).—Evaporation through layers of paraffin oil 0.5—5 μ. thick, obtained by means of spreading agents, has been investigated. Films 1—2 μ. thick which reduce evaporation by 50—60% are easily obtained. The best films are obtained from dil. (1 : 50) solutions of boiled linseed oil, stand oil, terebinth oil, or high-boiling fractions of eucalyptus oil in white paraffin oil. High reductions (~99%) are obtained with thin films (0.5—1.0 μ.) of certain high-boiling fractions of the neutral oil of vertical-retort tar. Reduction of evaporation in a wind is $>$ in still air, if the continuity of the film is not seriously affected by the wind. L. S. T.

Foaming.—See B., 1940, 711, 712.

Stability of emulsions. II. Emulsions stabilised by hydrophilic colloids. A. KING and L. N. MUKHERJEE (J.S.C.I., 1940, **59**, 185—191; cf. A., 1939, I, 468).—Emulsions of olive oil and kerosene stabilised by (1) agar, (2) gelatin, (3) gums acacia and tragacanth, (4) egg yolk, (5) lecithin, (6) Irish moss, and (7) saponin were examined by the size-frequency technique when freshly prepared and after various times. All these emulsions except (5) deteriorated by gradual increase of droplet size without oil separation. The coarser emulsions were very stable. HCl and $CaCl_2$ broke or inverted (4) and (7) and coarsened the other systems. Heating coarsened all systems, the effect corresponding with viscosity change.

Emulsifying power of some natural emulsifiers. N. F. JERMOLENKO and V. J. GUTERMAN (Kolloid. Shurn., 1938, **4**, 85—91).—The emulsifying power of bile, as evaluated by drop-no. measurements, is the greater the greater is the difference in polarity between the two phases to be emulsified, and is considerable even in the system C_6H_6-H_2O. With both bile and egg-yolk the emulsifying power arises from the presence of highly surface-active substances and the power of forming a tough interfacial film. R. C.

Determination of dimensions of colloid particles. S. E. CHARIN (Kolloid. Shurn., 1938, **4**, 77—83).—A simple comparative nephelometric method for determining degree of dispersity is described. For technical sols which are not deeply coloured the spectrophotometer may be used. The size of the colloid particles in starch syrup has been determined by diffusion measurements. R. C.

Systems of four components. II. Stability of ferric hydroxide hydrosols. I. MARKEVITSCH and M. CHOLODOVA (Kolloid. Shurn., 1938, **4**, 63—66).—The presence of various org. acids in the prep. of $Fe(OH)_3$ sols reduces their sensitivity to EtOH. In presence of tartaric acid yellow forms of $Fe(OH)_3$ appear which adsorb $H_2C_2O_4$ more readily than does brown $Fe(OH)_3$, and, unlike the latter, can, after drying, be partly peptised by H_2O. R. C.

Constitution of colloidal silica. P. C. CARMAN (Trans. Faraday Soc., 1940, **35**, 964—973).—Assuming that in SiO_2 the surface Si ions tend to complete the $-Si-O-$ tetrahedra that are the characteristic structural units of both SiO_2 and silicates, it follows that a single layer of H_2O mols. will be bound so strongly at a SiO_2 surface as to give, in effect, surface OH groups with a weak tendency to dissociate and form H ions. Further, since OH does not form part of the internal structure, hydration of SiO_2, unlike that of, e.g., CaO, is confined to the surface; transition from massive SiO_2 to a mol. of $Si(OH)_4$ is therefore continuous and the degree of hydration depends entirely on the degree of subdivision. The coarsening of SiO_2 sols with time, their behaviour towards electrolytes, the formation and irreversible shrinkage of SiO_2 gels, and the constitution of Na silicates are explained on the same basic assumption. F. L. U.

Dielectric study of synthetic highly polymerised compounds in organic liquids. I—III. Dielectric study of benzene solutions of mono- and poly-chloroprene, mono- and poly-vinyl acetate, and mono- and poly-styrene. S. LEE (J. Soc. Chem. Ind. Japan, 1940, **43**, 190—191B).—A summary of work previously noted (A., 1939, I, 469). F. L. U.

Binding of water by stearanilide. B. A. TOMS (Nature, 1940, **146**, 266).—Fractional pptn. by H_2O of a 0.1% solution of stearanilide in EtOH and measurements of η of the filtered solutions give results that support the view (A., 1940, I, 360) that "bound" H_2O in the hydrated anilides of stearic and palmitic acids is held by a micellar structure. L. S. T.

Influence of starch cations on certain properties of the starch. J. DEDEK, B. JELINEK, and I. KULCICKYJ (Ann. Ferm., 1936, **2**, 79—85; Chem. Zentr., 1937, i, 4644).—Changes of η with temp. are identical for starches treated with NaCl and $CaCl_2$, but different for HCl-treated specimens; η rises rapidly and then falls as the temp. increases. The swelling properties differ in each case. A. J. E. W.

Reactions relating to carbohydrates and polysaccharides. LXII. Relation between concentration and viscosity of polyoxyethylene glycols. LXIII. Surface tensions of aqueous solutions of polyoxyethylene glycols. E. L. Lovell and H. Hibbert (J. Amer. Chem. Soc., 1940, **62**, 2140—2143, 2144—2148).—LXII. η of 42- and 90-membered oxyethylene glycols and the 42-membered dichloride in dioxan, and of the 186-membered glycol in CCl_4, have been measured at 20° and over the concn. ranges 1—4.5% and 2—10% respectively. For dil. solutions (<5%) a linear relationship exists between η and concn. (c), and the Arrhenius equation, $\log \eta = Kc$ holds at all concns. Vals. of sp. η are additive and the polyoxyethylene chain appears to be highly convoluted in solution.

LXIII. γ of aq. solutions of single polymeric oxyethylene glycols (3, 6, 18, 42, 90, and 186 repeating units respectively; cf. A., 1939, II, 402) have been measured at various concns. and mol. areas are calc. from Gibbs' adsorption isotherm. Lowering of γ for the 18, 42, 90, 186 members is a linear function of $\log c$.

W. R. A.

Behaviour of cellulose in alkaline solutions.—See B., 1940, 728.

Dissolution of cellulose esters. IV. Relation of interaction between individual particles of solute to integral heat of dissolution of cellulose esters. Z. Rogovin and V. Ivanova (Kolloid. Shurn., 1938, **4**, 19—30).—The integral heat of dissolution, q, of cellulose acetate or nitrate in $COMe_2$ increases with the concn., supposedly owing to diminishing dissociation of the micelles. For a given concn. of a given ester q is the smaller the larger is the particle size. The formation of dil. solutions of esters is accompanied by the absorption of an amount of heat which is the greater the higher is the degree of dissociation of the chains in the solution, and the longer are the chains. The dilution of swollen gels causes no material heat effect. R. C.

Variations of viscosity of sols of lyophilic colloids. IV. Cellulose-cuprammonium sols. F. M. Schemjakin and M. E. Kuperman (Kolloid. Shurn., 1938, **4**, 31—34).—The effect on η of various salts at concns. up to those required to produce visible coagulation has been measured. In general, η passes through a series of max. and min. with increasing salt concn. R. C.

Apparent molecular shape and mol. wt. of proteins, from viscosity and diffusion measurements. H. Neurath and G. R. Cooper (J. Amer. Chem. Soc., 1940, **62**, 2248—2249).—The apparent mol. shapes (axial ratios for prolate and oblate ellipsoids) and mol. wt. have been deduced from η and diffusion measurements for cryst. lactoglobulin, cryst. carbohydrate-free serum-albumin, serum-glycoid, cryst. pepsin, and three euglobin-free horse pseudoglobulin fractions pptd. at p_H 5·2 by 1·36, 1·6, and 2·1м-$(NH_4)_2SO_4$. W. R. A.

Freezing of inorganic hydrogels. S. Uno (J. Soc. Chem. Ind. Japan, 1940, **43**, 197—198в).—A no. of gelatinous ppts., including metal hydroxides, carbonates, and sulphides, are converted into a com-

pact form which readily settles and is easily filtered, by freezing in contact with the mother-liquor or H_2O. F. L. U.

Ageing of sols and gels. IV. Syneresis in mercury acetamide gels. E. M. Preis (Kolloid. Shurn., 1938, **4**, 55—62).—The kinetics of syneresis in presence of KNO_3 are those of a unimol. heterogeneous reaction; the effect of temp. has been examined. R. C.

Controlled flocculation. D. L. Tilleard (Proc. Physical Soc., 1940, **52**, 828).—Thin films of pastes consisting of fine solid particles dispersed in a viscous liquid show marked changes in dispersion under slow shear, the particles becoming packed in long cylindrical flocculates so fine and regularly spaced as to give bright diffraction spectra. N. M. B.

Kinetics of polymerisation and coagulation. A. V. Dumanski and J. D. Fridman (Kolloid. Shurn., 1938, **4**, 67—76).—The processes of polymerisation and coagulation are analogous, the process of coagulation visualised by Smoluchowski's theory being identical with that of a chain reaction with branching chains. From this similarity the equation $\log_e M = \log_e M_0 + \alpha\tau$ has been deduced for a polymerisation process, where M_0 is the initial mol. wt., M that after time τ, and α a function of the temp. and η. Experiments on the polymerisation of C_6H_6 solutions of butadiene in presence of Na have given results for M agreeing with those obtained from η by Staudinger's method. It seems probable that the slowing down of polymerisation reactions in solution is largely due to solvation. The time–distribution curves for various polymerides in the above reaction have been obtained. R. C.

Electrolyte coagulation process. Influence of dilution of sol on adsorption of precipitating ions. H. B. Weiser and W. O. Milligan (J. Amer. Chem. Soc., 1940, **62**, 1924—1930).—The effect of concn. of sol on the pptn. val. of electrolytes for relatively pure sols of $Cu_2Fe(CN)_6$, Fe_2O_3, and As_2S_3, and of the adsorption of pptg. ions at their respective pptn. vals., has been studied. With each sol marked variations from the rule of Burton and Bishop were observed. For a given sol the proportionate increase in stability towards pptg. electrolytes on dilution is, for electrolytes with univalent pptg. ions, generally > for those with multivalent pptg. ions, and increases with the purity of the sol. The Ostwald rule does not apply. W. R. A.

Irregular series of colloidal solutions by electrolytes. II. Mastic sol. N. Sata and S. Ito (Bull. Chem. Soc. Japan, 1940, **15**, 271—275).—Irregularities in the curves of stability of mastic sol against concn. of $FeCl_3$ are removed when the sol is purified by prolonged dialysis, and are not restored by subsequent addition of electrolytes. On the other hand addition of EtOH, MeOH, or $COMe_2$ restores the irregularity. Accordingly the irregularities are connected with the presence, in the colloid particles, of traces of EtOH arising from the mode of prep. F. J. G.

Periodic phenomena in the evaporation of solutions. G. F. Smith (Proc. Leeds Phil. Soc., Sci. Sect., 1940, **3**, 603—608).—In the vac. evapor-

ation of very dil. solutions of certain salts the solute is deposited on the walls of the containing vessel in the form of very fine rings parallel to the surface of the liquid. The distance between the rings increases with the rate of evaporation. The mechanism of the production of the rings is considered, and a possible explanation given.   A. J. M.

Ionisation in non-aqueous solvents. III. Formation of sulphides in methyl and in ethyl alcohol. W. L. GERMAN and T. W. BRANDON (J.C.S., 1940, 1329—1333; cf. A., 1938, I, 458).—Investigation of the reactions between Na_2S and $AgNO_3$, CdI_2, $CuCl_2$, $HgCl_2$, $CoCl_2$, and $NiCl_2$ in anhyd. MeOH and EtOH shows that complete double decomp. takes place with the first three salts. With the last three salts double decomp. is incomplete, the ppts. being of the type $(RCl_2)_x,(RS)_y$.   C. R. H.

Temperature variation of ionisation constants of weak electrolytes. H. S. HARNED and R. A. ROBINSON (Trans. Faraday Soc., 1940, **36**, 973—978). —Out of 5 equations representing the temp. variation of ionisation const. (K) of weak electrolytes which have been compared with experimental data one, $-RT \log_e K = A - CT + DT^2$, is selected on the grounds of ease of computation and of ability to represent the data within the limits of experimental error. The best data on K for H_2O are surveyed critically.   F. L. U.

Dissociation of calcium and magnesium phosphates. I. GREENWALD, J. REDISH, and A. C. KIBRICK (J. Biol. Chem., 1940, **135**, 65—76).—The titration of H_3PO_4 with NaOH in the presence of KCl, NaCl, $MgCl_2$, and $CaCl_2$ has been studied potentiometrically. No difference in behaviour is observed until 1 equiv. of NaOH is added, but thereafter solutions containing $MgCl_2$ or $CaCl_2$ are more acid than those containing KCl or NaCl, this being attributed to the formation of $MgHPO_4$ and $CaHPO_4$, which are slightly dissociated. The dissociation const. (K) of $MgHPO_4$ is given by $-\log_{10} K = 2.50 - 2.15\sqrt{\mu}$, where μ is the ionic strength, whilst that for $CaHPO_4$ is slightly higher.   J. W. S.

Conductance, dissociation constant, and heat of dissociation of triethylamine in water. J. E. ABLARD, D. S. McKINNEY, and J. C. WARNER (J. Amer. Chem. Soc., 1940, **62**, 2181—2183).—Vals. of Λ and K have been determined for aq. NEt_3 of various concns. at 25°, 40°, and 50°. The mean heat of dissociation is 1280 g.-cal. per mol.   W. R. A.

Thermodynamic properties of solutions of amino-acids and related substances. VI. Activities of some peptides in aqueous solution at 25°. E. R. B. SMITH and P. K. SMITH (J. Biol. Chem., 1940, **135**, 273—279).—The v.p. of aq. solutions of glycylglycine, triglycine, alanylglycine, glycylalanine, and alanylalanine have been determined at 25° by Robinson and Sinclair's isopiestic method (A., 1934, 1173), and the osmotic and activity coeffs. of the peptides are calc. It is shown that, as with the α-NH_2-acids (A., 1939, I, 144), the mol. change in the activity coeff. $-(\log\gamma)/C$ varies linearly with the change in the dielectric const. of the solution ϵ_0/ϵ.   J. W. S.

Solubility of arsenious oxide in dilute solutions of hydrochloric acid and sodium hydroxide. Character of the ions of tervalent arsenic. Evidence for polymerisation of arsenious acid. A. B. GARRETT, O. HOLMES, and A. LAUBE (J. Amer. Chem. Soc., 1940, **62**, 2024—2028).—Measurements of the solubility of As_2O_3 at 25° in aq. NaOH (0·16—6M.) indicate the formation of AsO_2', HAs_2O_4', and $H_2As_3O_6'$ ions. The ionisation const. of H_3AsO_3 is $2·4 \times 10^{-10}$. The system As_2O_3–HCl has also been investigated (HCl 0·04—8·1M.). Min. solubility occurs in 3—4M-HCl; AsOCl appears to be the principal mol. present at concn. of HCl of 3—6·5M. Assuming As_2O_3 as solid phase the hydrolysis const. of $AsCl_3$ has been calc.   W. R. A.

Curve representing yield of undissociated compound in binary systems. V. J. ANOSOV (Ann. Sect. Anal. Phys.-Chim., 1940, **12**, 15—17).— Theoretical.   R. T.

Phase equilibria in hydrocarbon systems. Methane–n-butane system in the two-phase region. B. H. SAGE, B. L. HICKS, and W. N. LACEY (Ind. Eng. Chem., 1940, **32**, 1085—1092).—The compositions and the sp. vols. of the coexisting phases of the system CH_4–n-C_4H_{10} have been determined at 70—250° and at various pressures covering the full two-phase region. Gas–liquid equilibrium consts. and the fugacities of the components are derived.
     J. W. S.

Organic molecular compounds. III. Molecular compound formation of aromatic hydrocarbons with nitro-compounds and with antimony trihalides. C. SHINOMIYA (Bull. Chem. Soc. Japan, 1940, **15**, 259—270).—M.p. data are given for binary systems consisting of pyrene (A) or fluoranthene (B) with s-$C_6H_3(NO_2)_3$ (C), picramide (D), trinitrocresol (E), $1:2:4:6$-$C_6H_2Me(NO_2)_3$ (F), picryl chloride (G), $2:4$-$(NO_2)_2C_6H_3\cdot OH$ (H), $1:2:4$-$C_6H_3Me(NO_2)_2$ (K), $2:4:6$-$(NO_2)_3C_6H_2\cdot OMe$ (L), p-$C_6H_4(NO_2)_2$ (M), or m-$C_6H_4(NO_2)_2$ (N), and of A, B, acenaphthene (P), anthracene (Q), phenanthrene (R), or fluorene (S) with $1:2:4:6$-$C_6H_2(NO_2)_4$ (T). The following *compounds* are recorded : AC, m.p. 245·5°; BC, m.p. 205·0°; AD, m.p. 236·0°; BD, m.p. 191·5°; AE, m.p. 163·0°; BE, m.p. 144·0°; AF, m.p. 164·5°; BF, m.p. 133·0°; AG, m.p. 154·0°; BG, m.p. 120·0°; AH, m.p. 146·3°; BH, m.p. 92·0°; AK, m.p. 92·5°; BK, m.p. 75·5°; AL, m.p. 104·5°; BL, m.p. 75·0°; AM; AN, m.p. 92·7°; AN, m.p. 89·3°; BN, m.p. 77°; AT, m.p. 168·5°; BT, m.p. 134·0°; PT, m.p. 110·5°; QT, m.p. 171·0°; R_2T_3, m.p. 125·0°; RT; ST_2, m.p 130·0°; $3C,2C_6HMe_5$, m.p. 121·0°; $C,4':4'$-$(C_6H_4Me)_2$, m.p. 91·0°; picric acid–stilbene, $1:1$, m.p. 93·0°; $C,2NHPh_2$, m.p. 100·0°. These are tabulated and compared with known analogous compounds, and with mol. compounds between aromatic hydrocarbons and $SbCl_3$ or $SbBr_3$.
     F. J. G.

Systems magnesium chromate–water and ammonium chromate–water from 0° to 75°. A. E. HILL, G. C. SOTH, and J. E. RICCI (J. Amer. Chem. Soc., 1940, **62**, 2131—2134).—The aq. solubilities of $MgCrO_4$ and $(NH_4)_2CrO_4$ have been determined from 0° to 75°. The saturating phases of the

$MgCrO_4–H_2O$ system are $MgCrO_4,7H_2O$ and $MgCrO_4,5H_2O$, the transition temp. for the two hydrates in contact with solution being $17\cdot2°$ at $35\cdot15\%$ $MgCrO_4$. From the loss in wt. of $MgCrO_4,5H_2O$ at different temp. the following transitions have been recorded : $5H_2O \rightleftharpoons 2H_2O$ (50—60°); $2H_2O \rightleftharpoons H_2O$ (100—110°); $H_2O \rightleftharpoons$ anhyd. (160—170°). W. R. A.

Geometrical transformations of components of binary and ternary systems, involving formation of compounds. V. P. SCHISCHOKIN (Ann. Sect. Anal. Phys.-Chim., 1940, **12**, 5—10).—Geometrical methods of representating transformations are explained. R. T.

Two-phase equilibrium in binary and ternary systems. II. System methane–ethylene. III. System methane–ethane–ethylene. M. GUTER, D. M. NEWITT, and M. RUHEMANN (Proc. Roy. Soc., 1940, **A**, **176**, 140—152).—The liquid-vapour equilibria of the systems were determined over a wide range of pressure at temp. between 0° and —104°.

G. D. P.

Physico-chemical analysis of the mutual system $2NaCl + MgSO_4 \rightleftharpoons Na_2SO_4 + MgCl_2$, as applied to salt lakes. I. Annual cycles of Lake Elton. I. B. FEIGELSON and A. G. BERGMAN (Ann. Sect. Anal. Phys.-Chim., 1940, **12**, 157—188).—Phase diagrams are given for the system at 5° intervals from —20° to 35°. The results are applied to the conditions prevailing in Lake Elton (cf. A., 1940, I, 421).

R. T.

20° isotherm of the ternary system : manganous nitrate–nitric acid–water. W. W. EWING and C. F. GLICK (J. Amer. Chem. Soc., 1940, **62**, 2174—2176).—The system $Mn(NO_3)_2–HNO_3–H_2O$ has been investigated at 20°. The following hydrates exist in stable equilibrium with HNO_3 at 20° : 6, 4, 2, $1\cdot5$, 1, $0\cdot5H_2O$. No evidence of the tri- or hemipentahydrate was obtained. W. R. A.

Equilibrium of system $NH_3–P_2O_5–SO_3–H_2O$. I. Ternary systems $(NH_4)_2SO_4–H_3PO_4–H_2O$ and $(NH_4)_2SO_4–(NH_4)_2H_3SO_4PO_4–H_2O$. II. Ternary system $(NH_4)_2SO_4–NH_4H_2PO_4–H_2O$. III. Ternary system $NH_4H_2PO_4–H_3PO_4–H_2O$ and the quaternary system $NH_4H_2PO_4–(NH_4)_2H_3SO_4PO_4–H_3PO_4–H_2O$. S. UNO (J. Soc. Chem. Ind. Japan, 1940, **43**, 168—169B, 169B, 170B).—I. Data for the former system at 25° and 70° indicate the formation of $(NH_4)_2H_3SO_4PO_4$. Data for the latter system at 0°, 25°, 40°, 70°, and 100° are recorded.

II. Data for this system at 0°, 25°, 40°, 70°, and 100° do not indicate double salt formation.

III. Data for these two systems at 25° and 70° are recorded. Data for the system $(NH_4)_2H_3SO_4PO_4–H_3PO_4–H_2O$ at 25° and 70° have been calc. from data in part I. C. R. H.

Double decomposition in absence of a solvent. XLVII. Fusion diagrams of ternary systems of fluorides, chlorides, and sulphates of potassium and sodium. S. MUKIMOV. **XLVIII. Mutual irreversible system of nitrates and sulphates of potassium and thallium. XLIX. Ternary system : sodium, potassium, and thallium nitrates.** P. K. LEMAN. **L. Complex mutual system : potassium and thallium nitrates, chlorides, and sulphates.** A. P. ROSTKOVSKI (Ann. Sect. Anal. Phys.-Chim., 1940, **12**, 19—38, 39—50, 51—56, 57—63).—XLVII. Fusion diagrams are given for the binary systems $KF–K_2SO_4$ and $–KCl$, $KCl–K_2SO_4$, $NaCl–Na_2SO_4$ and $–NaF$, and $NaF–Na_2SO_4$, and the ternary systems $KF–KCl–K_2SO_4$ and $NaF–NaCl–Na_2SO_4$. The only compounds noted are of the type MF,M_2SO_4 (M = Na, K).

XLVIII. Fusion diagrams are given for the system $2KNO_3 + Tl_2SO_4 \rightleftharpoons 2TlNO_3 + K_2SO_4$, involving the binary systems $TlNO_3–Tl_2SO_4$ and $–KNO_3$, and $K_2SO_4–Tl_2SO_4$ and $–KNO_3$.

XLIX. The fusion diagram of the system $NaNO_3–KNO_3–TlNO_3$ suggests solid solution, but not compound, formation ; the ternary eutectic is at 138° ($NaNO_3$ 25, KNO_3 24, and $TlNO_3$ 51 mol.-%).

L. Two sections of the prism representing the system $KCl–KNO_3–K_2SO_4–TlCl–TlNO_3–Tl_2SO_4$ have been studied. Solid solutions, but not compounds, are formed. R. T.

Equilibria in liquid iron with carbon and silicon.—See B., 1940, 740.

Energies of isomerisation of hexanes. F. D. ROSSINI and E. J. R. PROSEN (J. Amer. Chem. Soc., 1940, **62**, 2250—2251).—The heats of combustion of the five isomeric hexanes have been determined and, from the data, the energies of isomerisation at 0° and 25° for both liquid and gaseous states have been calc. in terms of the relative energy content referred to n-C_6H_{14} as zero. There is a marked difference between β- (I) and γ-methylpentane (II) ; the difference between n-C_6H_{14} and βγ-dimethylbutane is approx. the sum of the differences between n-C_6H_{14} and (I) and n-C_6H_{14} and (II) ; the difference between n-C_6H_{14} and ββ-dimethylbutane is approx. the same as that between n-C_5H_{12} and CMe_4. Some thermodynamic vals. are calc. W. R. A.

Ionic entropies and free energies and entropies of solvation in water–methanol solutions. W. M. LATIMER and C. M. SLANSKY (J. Amer. Chem. Soc., 1940, **62**, 2019—2023).—Ionic entropies, free energies and entropies of solvation have been calc. for the pairs of ions $Na^{·} + Cl'$, $K^{·} + Cl'$, and $K^{·} + Br'$ in $H_2O–MeOH$ mixtures and vals. are discussed with reference to the nature of the solvation process. Free energies of solvation decrease in the range from pure H_2O to pure MeOH in approx. agreement with the change in dielectric const. Although energies of solvation in MeOH are $<$ in H_2O, entropies in MeOH are $\gg$ in H_2O. Tentative explanations are advanced.

W. R. A.

Electrolytic solutions. XXII. Conductance of ethylene dichloride solutions of quaternary ammonium salts having large negative ions. D. L. FOWLER and C. A. KRAUS (J. Amer. Chem. Soc., 1940, **62**, 2237—2240).—Λ of $NBu^a_4·OH,BPh_3$, NBu^a_4F,BPh_3, $NMe_4·OH,BPh_3,EtOH$, $NMe_4·OH,BPh_3,H_2O$, and NMe_4F,BPh_3 at $25\cdot00°$ in $(CH_2Cl)_2$ have been measured and are discussed. The complex fluoride is more stable than the corresponding hydroxide. Dissociation consts. of ion–ion pairs are computed. W. R. A.

Mechanism of hydrogen electrode process. A. FRUMKIN (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1940, **37**, 473—477).—A reply to Horiuti et al. (A., 1938, I, 255; 1939, I, 340). W. R. A.

Mixed potentials at the dropping mercury electrode. I. M. KOLTHOFF and C. S. MILLER (J. Amer. Chem. Soc., 1940, **62**, 2171—2174).—The significance of " mixed potentials " at the dropping Hg electrode is explained and illustrated by suitable examples and its importance in polarographic studies is discussed. The principle of a new type of amperometric titration in which the titrating media do not react chemically is described. Current–voltage curves for air-saturated solutions of 0.1N-NaOH with air-free Na_2S in the same medium, mixtures of O_2 and KCN in dil. NaOH, an air-free mixture of benzoquinone and HCN, and TlCl and KCN in NaOH are given and briefly discussed. W. R. A.

Electrochemical–acoustic phenomena. III. Possible causes of reception of sound by polarised electrodes. IV. Reception of sound by semipermeable membranes. L. V. NIKITIN (J. Gen. Chem. Russ., 1940, **10**, 97—101, 102—111; cf. A., 1936, 938; 1937, I, 141).—III. Possible explanations of the electro-acoustic effect are discussed.

IV. Currents are generated in collodion diaphragms between electrodes when notes of certain frequencies are sounded. The range of frequencies to which the membranes are sensitive extends with rising c.d., this applying to both the upper and the lower limit in the case of the cell $Cu|0.1\text{N-}CuSO_4|0.1\text{N-}CuSO_4|Cu$, and to the upper limit only in the case of $Pt|0.001\text{N-KCl}|0.001\text{N-KCl}|Pt$. Raising the concn. of the electrolyte raises both the upper and the lower limits of c.d. at which reception of sound is possible. The results support the view that sound-receptivity is a function of a semipermeable membrane forming on polarised electrodes. R. T.

Preferential and initial ionic recombination in gases. N. E. BRADBURY (J. Appl. Physics, 1940, **11**, 267—273).—Mathematical. A theory for the processes involved in preferential and initial ionic and electronic recombination is developed. J. W. S.

Rôle of free radicals in mechanisms of gaseous explosions. A. R. UBBELOHDE (Chem. and Ind., 1940, 657—659).—Previously suggested mechanisms for the combustion of hydrocarbons are discussed in the light of experimental knowledge of free radicals. The dissipation of energy from reacting mols. by third-body collisions, and localisation of radicals in " reaction cells," are also discussed briefly. A. J. E. W.

Explosive reactions of gases. I. Thermal explosion of oxy-hydrogen gas at low pressures. S. HORIBA and R. GOTO (Proc. Imp. Acad. Tokyo, 1940, **16**, 218—222).—Experiments in which the gas $(H_2 : O_2 = 2 : 1)$ contained in a spherical glass vessel is heated internally with a Pt strip or externally indicate that the low-pressure explosion is not a homogeneous process in the gas phase. H_2O vapour retards the explosive reaction, the retardation taking place on the surface of the containing vessel. D. F. R.

Effect of surface on cool flames in the oxidation of propane. R. A. DAY, jun., and R. N. PEASE (J. Amer. Chem. Soc., 1940, **62**, 2234—2237).—The cool-flame region in $1 : 1$ C_3H_8-O_2 mixtures has been investigated. The surface effects resulting from treatment of the reaction tube with KCl, HF, and HNO_3 are negligible. Possible mechanisms are discussed. W. R. A.

Homogeneous first-order gas reactions. XI. Decomposition of benzylidene diacetate, o-chlorobenzylidene diacetate, and benzylidene dibutyrate. N. A. D. PARLEE, J. C. ARNELL, and C. C. COFFIN (Canad. J. Res., 1940, **18**, B, 223—230; cf. A., 1939, I, 375).—Benzylidene and o-chlorobenzylidene diacetate and benzylidene dibutyrate decompose unimolecularly about six times as rapidly as ethylidene diacetate, at rates given by the equation previously found for crotonylidene and furfurylidene diacetates, viz., $k_1 = 1.3 \times 10^{11}e^{-33,000/RT}$. The esters with this identical reaction velocity all have a double bond at the same distance from the breaking point of the mol. D. F. R.

Effect of substitution on thermal decomposition of gaseous benzaldehyde. R. E. SMITH (Trans. Faraday Soc., 1940, **36**, 983—987; cf. A., 1940, I, 259).—Substitution in the p-position of Me or of Cl produces only slight change in the rates of the two reactions in the thermal decomp. of PhCHO. The effect of NO_2 cannot be inferred since the mechanism of decomp. of m-$NO_2 \cdot C_6H_4 \cdot CHO$ resembles that of $PhNO_2$ rather than that of PhCHO. Data for the decomp. of $PhNO_2$ vapour at 500° are recorded. F. L. U.

Rate of exchange of elementary radiosulphur with sulphur monochloride. R. A. COOLEY and D. M. YOST (J. Amer. Chem. Soc., 1940, **62**, 2474—2477).—At room temp. the rate of exchange of S* between S_8 and S_2Cl_2 is slow but at 100° proceeds at a measurable rate $\propto [S_8]$. The rate-determining step is the slow reversible dissociation $S_8 \rightleftharpoons S_6 + S_2$ and the exchange is effected by the rapid reversible reaction $S_2 + S_2Cl_4 \rightleftharpoons 2S_2Cl_2$. W. R. A.

Condensations of carbonyl compounds. Kinetic study of the reaction of acetophenone with benzaldehyde. (MRS) E. COOMBS and D. P. EVANS (J.C.S., 1940, 1295—1300).—The velocity of the condensation of PhCHO to COPhMe can be represented by $v = k[\text{PhCHO}][\text{COPhMe}][\text{OEt}']$. p-Substitution of OMe and Cl respectively increases and decreases v as a result of a respective decrease and increase in the energy of activation (E). p-Substitution of OMe and Cl into COPhMe respectively decreases and increases v, not as a result of changes in E, but as a result of a respective decrease and increase in the val. of PZ in the term $PZ.e^{-E/RT}$. Of two reaction mechanisms discussed, the more probable one involves a reaction between PhCHO and OEt′ followed by a reaction between the resulting complex ion and a suitably oriented COPhMe mol. C. R. H.

Kinetics of the degradation of polyesters by alcohols. P. J. FLORY (J. Amer. Chem. Soc., 1940, **62**, 2255—2261).—A method for studying the kinetics of polymeride degradation of polyesters from measure-

ments of η, based on the postulate that ester groups of polymeride mols. are attacked at random, has been devised. For the degradations of decamethylene adipate polyesters by decamethylene glycol and by lauryl alcohol the rate of reaction $\propto$ the concn. of acid catalyst, and the rate coeffs. decrease slightly with increasing concn. of OH groups.   W. R. A.

Rate and mechanism in the reactions of benzyl chloride with water, hydroxyl ion, and acetate ion. G. W. BESTE and L. P. HAMMETT (J. Amer. Chem. Soc., 1940, **62**, 2481—2487).—The rates of first-order solvolytic reaction of CH_2PhCl and of its second-order reactions with OH' and OAc' ions in dioxan–H_2O (60·72 : 39·28) at 50° have been measured. Pronounced salt and medium effects with relatively small changes in the nature of the medium were found, the sp. rates varying with initial concn. of reactants. Both Cl' and OAc' ions retard the solvolytic reaction, the mechanism of which is discussed.
                                                                W. R. A.

Kinetics of saponification of ethyl esters of several phenyl-substituted acids. H. S. LEVENSON and H. A. SMITH (J. Amer. Chem. Soc., 1940, **62**, 2324—2327).—The kinetics of saponification in 85% aq. EtOH for Et phenylacetate, β-phenylpropionate, γ-phenylbutyrate, δ-phenylvalerate, hydratropate, phenylethyl-, diphenyl-, and *cyclo*hexyl-acetate at 25°, 35°, 45°, and 55° have been investigated. The negative inductive effect of Ph is indicated and the steric influence of α-substituted Ph on the rate and activation energy affects the reaction kinetics to a greater extent than polarisation effects due to Ph.
                                                                W. R. A.

Electrostatic influence of substituents on reaction rates. II. F. H. WESTHEIMER (J. Amer. Chem. Soc., 1940, **62**, 1892—1895; cf. A., 1940, I, 222).—The Kirkwood–Westheimer electrostatic equations have been applied successfully to the calculation of the effect of *p*-substituents on the rate of saponification of phenylacetic, β-phenylpropionic, benzoic, and cinnamic esters, to the rate of alkaline hydrolysis of benzamides, and to reaction rate of $CHPh_2Cl$ with NaI. An approx. expression has been derived for dipole–dipole interaction, and accounts satisfactorily for substituent effects on alkylation rate of NMe_3 by substituted Me benzoates.   W. R. A.

Mechanism of Wurtz reaction. R. B. RICHARDS (Trans. Faraday Soc., 1940, **36**, 956—960).—The rate of reaction of Na with EtI in C_6H_{14} at the b.p. $\propto$ [EtI], with a const. excess of Na. Increase in the surface area of the Na with const. initial [EtI] causes a reduction in the yield of C_4H_{10} and an increase in that of C_2H_6, the yield of C_2H_4 being little affected. Under similar conditions EtI reacts ~7 times as fast as $Pr^\beta I$. It is inferred that an initial reaction of 1 mol. of EtI with Na gives rise to Et, which then reacts with EtI to give C_4H_{10}, or with another Et to give $C_2H_6 + C_2H_4$. Side reactions of Et with C_2H_4 and with C_6H_{14} probably occur, since small amounts of resinous hydrocarbons are formed.   F. L. U.

Kinetics of decomposition of benzenediazonium chloride in water. E. A. MOELWYN-HUGHES and P. JOHNSON (Trans. Faraday Soc., 1940, **36**, 948—956).—The rate of decomp. of purified PhN_2Cl in aq.

solution at 288° and 333° K. conforms to a simple unimol. law, the temp.-variation of the velocity coeff. being given by $\log_e k = C + (J/R)\log_e T - E/RT$, where J is -36 g.-cal. per mol. PhCl was not formed during the experiments. The rate of decomp. is increased by large concns. of HCl or of PhOH.
                                                                F. L. U.

Kinetics of oxidation of organic compounds by potassium permanganate. II. 2 : 6-Dinitrophenol. E. A. ALEXANDER and F. C. TOMPKINS (J. S. African Chem. Inst., 1940, **23**, 33—40).—Apparatus for measuring the amount of gas evolved during a chemical reaction is described, and used to investigate the oxidation of 2 : 6-dinitrophenol (I) by $KMnO_4$. Addition of F' decreases the rate of oxidation, and shows that MnO_4' plays no part in it. Addition of $MnSO_4$ shows that $Mn^{....}$ is the most important factor, and max. acceleration in the rate is obtained when $Mn^{..} : MnO_4'$ is 0·5. There is then no induction period, and the reaction is bimol. Below a certain p_H the addition of MnO_2, pptd. from $Mn^{..}$ and MnO_4', produces an acceleration $\propto [H^.]^2 \times [MnO_2$ in solution]. (I) forms a complex with $Mn^{...}$, but complex formation plays little part in the oxidation. A yellow intermediate oxidation product, m.p. 91°, has been isolated. Previous conclusions concerning the mechanism of the oxidation (A., 1939, I, 570) are supported by the new measurements.
                                                                L. S. T.

Carbamide. III. Hygroscopicity of carbamide and inorganic salts. W. SAKAI (J. Soc. Chem. Ind. Japan, 1940, **43**, 190B; cf. A., 1940, I, 354).—The rate of absorption of H_2O from the atm. by $CO(NH_2)_2$ or by any H_2O-sol. solid $\propto$ the surface area and the difference between the partial pressure of H_2O vapour in the atm. and the v.p. of a saturated solution of the solid. Under certain conditions, however, solids may be non-hygroscopic even when this difference has a small positive val.   F. L. U.

Physico-chemical conditions of dissolution of gold and its alloys in solutions of cyanides. I. I. N. PLAKSIN and S. K. SCHABARIN (Ann. Sect. Anal. Phys.-Chim., 1940, **12**, 65—84).—The curve connecting velocity of dissolution, v, of Au or 9 : 1 Au–Ag with [KCN] is made up of an ascending, a horizontal, and a descending branch; these correspond, respectively, with conditions of excess of O_2 over KCN, equality of $[O_2]$ with [KCN], and excess of KCN over O_2. Max. v is obtained with 0·2—0·3% KCN. When the metal is rotated the val. of v rises, with increasing velocity of rotation, to a max. depending on the nature of the metal (Au–Ag > Au–Cu > Au) and on the [KCN]. Addition of H_2O_2 may cause increase in v, by effecting depolarisation, or may diminish v as a result of formation of an oxide film on the metal.   R. T.

Catalytic effect of osmium compounds on the reduction of perchloric acid by hydrobromic acid. W. R. CROWELL, D. M. YOST, and J. D. ROBERTS (J. Amer. Chem. Soc., 1940, **62**, 2176—2178).—The reaction between $HClO_4$ and HBr is catalysed by Os^{IV} compounds. Using K_2OsBr_6, rate experiments show that the rate $\propto [Os^{IV}]$, $[ClO_4']$,

[H'], and, in the later stages, ∝ [Br']. A mechanism is advanced, the rate-determining step being $OsBr_6'' +$ $H^+ + ClO_4' \rightarrow OsBr_6OH' + ClO_3'$.　　W. R. A.

Comparison of esterification and ester interchange kinetics. P. J. FLORY (J. Amer. Chem. Soc., 1940, **62**, 2261—2264).—Rate coeffs. and activation energies for the acid-catalysed polyesterification of adipic acid by decamethylene glycol (I) and the alcoholysis of decamethylene adipate polyester by (I) are given. For carboxylic acids as catalysts at 109° the rate coeffs. are approx. equal, whilst for p-$C_6H_4Me\cdot SO_3H$ as catalyst at 109° the rate coeff. for polyesterification is ~11 times the rate coeff. for alcoholysis, the activation energies being 12, 150, and 11,150 g.-cal., respectively.　　W. R. A.

Base-catalysed prototropy of substituted acetones. R. P. BELL and O. M. LIDWELL (Proc. Roy. Soc., 1940, **A**, 176, 88—113).—The halogenation velocity at 25° was measured for $COMe_2$, $(CH_2Ac)_2$, $COMe\cdot CH_2Cl$, $COMe\cdot CH_2Br$, $COMe\cdot CHCl_2$, and CH_2Ac_2. The catalysts studied were the anions of $CH_2Cl\cdot CO_2H$, $OH\cdot CH_2\cdot CO_2H$, AcOH, and $Bu^\gamma CO_2H$. The consts. of the Brönsted equation are evaluated, and the exponent is found to decrease as the reactivity of the ketone increases. The catalytic coeffs. of the H_2O mol. are deduced; the OH' ion is much less effective as a catalyst than theory predicts.　　G. D. P.

Potential energy curves in proton transfer reactions. R. P. BELL and O. M. LIDWELL (Proc. Roy. Soc., 1940, **A**, 176, 114—121).—The potential energy curves involved in proton transfer reactions are discussed with special reference to the base-catalysed prototropy of ketones. The assumption of covalent binding fails to account for the relations observed between basic strength and catalytic power. Approx. calculations show that the ionic state is of importance and the energy curves deduced give a more satisfactory picture of the experimental facts (cf. preceding abstract).　　G. D. P.

Acid catalysis in non-aqueous solvents. IX. Mutarotation of α-nitrocamphor in chlorobenzene solution. R. P. BELL and J. A. SHERRED (J.C.S., 1940, 1202—1205).—The catalytic activity of five org. acids in the mutarotation of α-nitrocamphor in PhCl measured at 25° shows that the reaction is of the first order and that there is an approx. linear relation between log catalytic const. and log dissociation const. in H_2O. Discussion of the mutarotation mechanism suggests that it is analogous to the inversion of menthone and to the mutarotation of α-chloro- and α-bromo-camphor, i.e., the interconversion of two stereoisomerides rather than of a normal nitro- and an aci-nitro-form.　　C. R. H.

Oxidation of ascorbic acid by oxygen with cupric ion as catalyst. A. O. DEKKER and R. G. DICKINSON (J. Amer. Chem. Soc., 1940, **62**, 2165—2171).—The oxidation of ascorbic acid (I) by O_2 in presence of $Cu^{..}$ ions ∝ [(I)], [$Cu^{..}$], and inversely ∝ $[H^+]^2$. The ascorbate ion appears to be initially oxidised by $Cu^{..}$ ions to a semiquinone-like ion which is immediately oxidised by O_2 to dehydroascorbic acid. The [$Cu^{..}$] is maintained const. by the oxidation of $Cu^{.}$ ions by O_2. The sp. reaction rate increases during the

reaction owing to the accumulation of H_2O_2 formed when $Cu^{.}$ ions are oxidised by O_2. Addition of $Fe^{...}$ ions accelerates the reaction markedly.　　W. R. A.

Activation of phosphatases.—See A., 1940, III, 767.

Heteropoly-acids as catalysts for vapour-phase partial oxidation of naphthalene. M. M. MARISIC (J. Amer. Chem. Soc., 1940, **62**, 2312—2317).—The use of heteropoly-acid catalysts for the partial oxidation of $C_{10}H_8$ to $(CH\cdot CO)_2O$ and o-$C_6H_4(CO)_2O$ has been investigated at a no. of temp. between 300° and 520°, using different mol. ratios of $C_{10}H_8$ to air, space velocities, and times of contact. The efficiencies of V_2O_5 and phosphomolybdic acid are approx. equal but < that of a catalyst prepared from NH_4 phosphovanadotungstate. MoO_3 was promoted by P, Sn, and Si but "poisoned" by As, Ni, and Cr, all of which promote the oxidation of the primary reaction products.　　W. R. A.

Catalytic reactions. A. J. CURRIER (J. Chem. Educ., 1940, **17**, 262—267).—Autocatalytic reactions, especially the drying of linseed oil in presence of metallic salts of org. acids, are discussed.
　　L. S. T.

Catalytic hydrogenation with deuterium. D. RITTENBERG, S. RATNER, and H. D. HOBERMAN (J. Amer. Chem. Soc., 1940, **62**, 2249—2250).—When maleic acid is catalytically hydrogenated by shaking with active Pd or Pt in H_2O with D_2 gas the succinate ion (I) formed has a D content 3—5 times that of the liquid phase. Conversely, when the system contains D_2O and H_2 gas (I) has practically no D. The reaction is faster than that between H_2 and H_2O but the mechanism is unknown. Reduction of α-ketoglutaric acid (i) with H_2 in an ammoniacal solution of 6·7% D_2O with Pd gave a glutamic acid, $C_5H_{8.963}D_{0.037}O_4N$, yielding, on degradation with chloramine-T, a Ba succinate, $C_4H_{3.964}D_{0.036}O_4Ba$; and (ii) with D_2 in ordinary H_2O gave a glutamic acid, $C_5H_{7.61}D_{1.39}O_4N$, and the corresponding Ba succinate, $C_4H_{2.87}D_{1.13}O_4Ba$. From these data it is calc. that the α- and β-H atoms contained 26 and 56 at.-% D respectively. The significance of the results is discussed.　　W. R. A.

Catalytic formation of potassium nitrite from potassium nitrate in liquid ammonia. F. W. BERGSTROM (J. Amer. Chem. Soc., 1940, **62**, 2381—2384).—KNH_2 reduces KNO_3 in liquid NH_3 to KNO_2 thus: $3KNH_2 + 3KNO_3 = 3KOH + 3KNO_2 + N_2 + NH_3$, particularly in the presence of Fe_2O_3, Co_2O_3, NiO, and CuO. Mn_3O_4 is less effective, and Cr_2O_3, Al_2O_3, ZnO, and Fe wire are poor catalysts. Since KOH catalyses the reduction slightly the above equation appears to be autocatalytic. The catalysts react with KNH_2 to give KOH and K ammonometallates, e.g., $CuNK_2,xNH_3$. In liquid NH_3 there is a slow reaction between KNH_2 and KNO_2, giving KOH and N_2, in the presence of Co_2O_3 and Fe_2O_3. KN_3 is not formed in reactions catalysed at room temp. but is formed at higher temp. when the catalyst is absent.
　　W. R. A.

Catalytic dehydrogenation of representative hydrocarbons. A. G. OBLAD, R. F. MARSCHNER,

and L. HEARD (J. Amer. Chem. Soc., 1940, **62**, 2066—2069).—Representative hydrocarbons of all classes have been dehydrogenated over Cr oxide catalysts under identical high-rate, high-temp. conditions. *cyclo*Hexanes are converted into aromatic hydrocarbons and practically no residual products are formed. Paraffins are much less rapidly converted than *cyclo*hexanes and C is deposited and catalyst activity steadily decreases. Olefines are more readily converted than paraffins, but the decrease in activity and deposition of C are more pronounced. *cyclo*-Pentanes dehydrogenate slowly and large amounts of C are deposited. Simple methylated aromatic hydrocarbons are unaffected, but alkylated aromatic hydrocarbons are slowly dehydrogenated to products which readily poison the catalyst.   W. R. A.

Oxidation of sulphur dioxide at an activated vanadium catalyst. Stability of various vanadium catalysts.—See B., 1940, 736.

Catalytic activity of phthalocyanines in autoxidation of linseed oil and methyl linoleate.—See B., 1940, 745.

Electrochemical oxidation of cobalt. E. S. MITZELOVSKI and B. F. ORMONT (J. Gen. Chem. Russ., 1940, **10**, 161—164).—The oxide obtained by anodic oxidation of Co (c.d. 100—1500 amp. per sq. dm., at 33—150°) is a mixture of Co_2O_3 and CoO_2.
          R. T.

Variables in silver-plating solutions.—See B., 1940, 742.

Electrolytic production of manganese.—See B., 1940, 743.

Chemical action of electric discharges. XIX. Production of hydrocyanic acid and ammonia by the action of the high- and low-frequency electric arc on mixtures of nitrogen, carbon monoxide, and hydrogen at ordinary and low pressure. E. BRINER and H. HOEFER (Helv. Chim. Acta, 1940, **23**, 826—831; cf. A., 1938, I, 150).—The energy yields of the production of HCN under the above conditions or between electrodes covered with C are ≪ those obtained with hydrocarbon (I) mixtures. C or hydrocarbon radicals formed by the action of the arc on (I) are very suitable for the production of HCN. The formation of HCN and NH_3 is greatly favoured by the association of high frequency of arc and low pressure of gas.   H. W.

Electrochemistry of gases. K. G. EMELÉUS and J. W. BECK (Proc. Roy. Irish Acad., 1940, **46**, 49—63).—The formation of wall deposits on passage of a discharge through C_6H_6, $C_{10}H_8$, and thiophen vapours in the presence of He, and through C_2H_2, has been investigated. Observed regularities in the position of the deposits are discussed theoretically. No information as to the charged or neutral nature of the particles forming the deposit could be obtained by means of Langmuir probes. On passage of a discharge through a mixture of N_2 and H_2 in a tube cooled in liquid air, condensation occurred when the negative glow was close to the wall. On evaporation the condensed film gave rise to some permanent gas as well as to NH_3.   O. D. S.

Theory of photographic latent image formation. J. H. WEBB (J. Appl. Physics, 1940, **11**, 18—34).—Theories of the mechanism of the production of the photographic latent image are summarised and discussed.   J. W. S.

Relation of light intensity to lateral growth on a photographic plate. H. S. COLEMAN and H. L. YEAGLEY (J. Amer. Chem. Soc., 1940, **62**, 2246—2247).—The dependence of diameter of photographic images of stars (artificial and natural) on several parameters has been investigated. A certain discrepancy in reciprocity with respect to the relation between diameter, time, and intensity was noticed. Time and temp. of development, time and intensity of exposure, and plate characteristics are varied independently.   W. R. A.

Mercury-photosensitised reactions of propane. E. W. R. STEACIE and D. J. DEWAR (J. Chem. Physics, 1940, **8**, 571—576).—The Hg-photosensitised decomp. of C_3H_8 alone and in presence of H_2 has been investigated at temp. between 24° and 323°. The products of reaction are almost entirely H_2 and hexanes (Pr^β_2 and $Pr^\alpha Pr^\beta$). At 25° the quantum yield of H_2 is 0·15 and this val. increases at higher temp. The following mechanism is postulated Hg $(^3P_1)$ + C_3H_8 → Hg $(^1S_0)$ + Pr + H; Hg $(^3P_1)$ + H_2 → Hg $(^1S_0)$ + 2H; H + C_3H_8 → Pr + H_2; Pr → C_6H_{14}; 2H → H_2; Pr + C_3H_8 → C_6H_{14} + H.
          W. R. A.

Photochemical studies. XXXI. Systematic study of the near ultra-violet photochemical decomposition of acetone. D. S. HERR and W. A. NOYES, jun. **XXXII. Photochemical reaction between nitrous oxide and hydrogen.** J. W. ZABOR and W. A. NOYES, jun. (J. Amer. Chem. Soc., 1940, **62**, 2052—2059, 1975—1981).—XXXI. Using both 3130 and 2537 A. the primary process of decomp. in $COMe_2$ seems to be $COMe_2$ + $h\nu$ = Ac + Me and it is followed by (a) the spontaneous dissociation of some Ac radicals to give Me + CO, particularly at lower temp., (b) the decomp. of Ac radicals, particularly at high temp., to Me + CO, (c) diffusion of Ac radicals to the walls and dimerisation to Ac_2, (d) a homogeneous gas-phase reaction between Me and Ac radicals giving $COMe_2$, and (e) diffusion of Me radicals to the wall with production of C_2H_6. Quantum yields of CO and C_2H_6 formation and of $COMe_2$ disappearance have been determined for different temp., pressure, and intensities. The above mechanism accounts for the variation of quantum yield with λ. The most probable val. for the activation energy of the dissociation of Ac into CO and Me is 18 kg.-cal.

XXXII. In the photochemical reaction between N_2O and H_2, H_2O and NH_3 are both formed, thus suggesting that probably two primary reactions take place : N_2O + $h\nu$ = N_2 + O and N_2O + $h\nu$ = NO + N. The quantum yield of H_2O increases as the pressure of H_2 is increased and approaches 1 at room temp. NO is not produced when sufficient H_2 is present; addition of NO prevents formation of NH_3 but first lowers and then increases the quantum yield of H_2O. The mechanism is very complex and a scheme which accounts qualitatively for the data is advanced. Temp. has a profound effect on the

reaction, which appears to change its character as temp. rises. W. R. A.

Response of photographic materials to atomic particles. T. R. WILKINS (J. Appl. Physics, 1940, **11**, 35—45).—The effects of α-particles, protons, and deuterons on photographic emulsions and the applications of these effects are described and discussed. J. W. S.

Thermal diffusion separation of radioactive and ordinary hydrogen isotopes. G. T. SEABORG, A. C. WAHL, and J. W. KENNEDY (J. Chem. Physics, 1940, **8**, 639—640).—Using a Clusius–Dickel column the isotopic separation of D and H from $^3H^*$ and D_2 has been investigated with respect to mol. fraction and temp. The separation factor is independent of mol. fraction, and increases with rising temp. The effect of using columns in series is also discussed. W. R. A.

Para–ortho composition of hydrogen gas produced from hydrogen atoms. II. N. SASAKI and O. MABUCHI (Proc. Imp. Acad. Tokyo, 1940, **16**, 223—224; cf. A., 1936, 573).—H_2 formed in the reaction $H + HI = H_2 + I$ at $-120°$ has the normal ortho–para composition. D. F. R.

Examination and standardisation of magnesium trisilicate. H. SURFLEET and G. V. PORTER (Quart. J. Pharm., 1940, **13**, 109—121).—X-Ray examination of preps. is recommended; the diagram of a true, synthetic Mg trisilicate is identical with that of naturally occurring sepiolite. Methods for determining the $MgO : SiO_2$ ratio (correct vals. for which are $1 : 2.21$—2.28) are described. Genuine samples of Mg trisilicate have an antacid val. of 300 ml. of 0.05N-HCl (with a lag val. of ~50%) and an adsorption val. of ≮240 mg. of methylene-blue per g. (ignited wt.). F. O. H.

Sulphites of aluminium and iron at 30°. W. F. BARTZ (J. Amer. Chem. Soc., 1940, **62**, 2240—2241).— Equal wts. of dry $Al(OH)_3$ and H_2O were agitated at 30°. Measured amounts of SO_2 were injected and the pressures measured up to 300 mm. At 300 mm. SO_2 was withdrawn in measured amounts and the pressures measured. One basic Al sulphite is formed, $Al_2O_3,2SO_2,6H_2O$, colourless, stable in dry air, stable at <105° but decomp. at 105°, slowly sol. in H_2O. If air is not rigorously excluded SO_2 is oxidised. By similar methods $FeO,SO_2,6H_2O$ was prepared; it is stable in dry air, readily oxidised, and decomposes in moist air. W. R. A.

Indium. I. Indium oxalate and oxalatoindates. T. MOELLER (J. Amer. Chem. Soc., 1940, **62**, 2444—2446).—$H_2C_2O_4$ ppts. $In_2(C_2O_4)_3,10H_2O$ (I) from hot aq. $In_2(SO_4)_3$. When aq. $M_2C_2O_4$ solutions (M = Na, K, NH_4) are used the *dioxalatoindates* $NaIn(C_2O_4)_2,3H_2O$, $KIn(C_2O_4)_2,4H_2O$, and $NH_4In(C_2O_4)_2,2H_2O$ are pptd. The dioxalatoindate ion is assumed to be $[In(C_2O_4)_2(HO)_2]'$, capable of existing as *cis*- and *trans*-isomerides with the *cis*-form theoretically resolvable into two enantiomorphs. It is suggested that (I) may also be a dioxalatoindate $In[In(C_2O_4)_2(H_2O)_2]_3,14H_2O$, which on drying gives $In[In(C_2O_4)_2(H_2O)_2]_3,2H_2O$. Attempts to prepare K

trioxalatoindate gave only an indefinite material of approx. composition $K_2C_2O_4,2K_3[In(C_2O_4)_3],7H_2O$. W. R. A.

Reduction of nitrosylsulphuric acid by sulphur monoxide. C. J. WILKINS (J.C.S., 1940, 1157—1159).—The liberation of N_2 in this reaction is not due to reduction of NO or to the intermediate formation of N_2H_4 or NH_2OH. NO_2 is not irreversibly reduced by SO. $Na_2S_2O_3$ and $Na_2S_4O_6$ do not reduce $NO·SO_2·OH$ below NO. H_2S and $Na_2S_2O_4$ only slightly reduce $NO·SO_2·OH$, traces of NH_3 being formed. C. R. H.

Fluorination of thiophosphoryl trichloride. Thiophosphoryl chlorofluorides. H. S. BOOTH and (MISS) M. C. CASSIDY (J. Amer. Chem. Soc., 1940, **62**, 2369—2372).—Stepwise fluorination of $PSCl_3$ by SbF_3 in presence of $SbCl_5$ (cf. A., 1939, I, 622) yielded $PSCl_2F$, b.p. $64.7 \pm 0.5°$, $PSClF_2$, b.p. $6.3 \pm 0.5°$, and PSF_3, b.p. -52.3 ± 0.05, all colourless and readily hydrolysed in moist air. Solid $PSCl_3$ exists in two forms, α, m.p. $-40.8°$, β, m.p. $-36.2°$, and the α-form changes to the β-form on warming. $PSClF_2$ in certain concns. in air is spontaneously explosive. W. R. A.

Physicochemical properties of ammonium sulphophosphate, $(NH_4)_2H_3SO_4PO_4$. S. UNO (J. Soc. Chim. Ind. Japan, 1940, **43**, 197B).—NH_4 *sulphophosphate*, prepared from $(NH_4)_2SO_4$ and H_3PO_4, forms colourless monoclinic crystals, d 1.780. Empirical formulæ are given for the v.p. of saturated solutions at 15—40°, and for the solubility in H_2O at 0—100°. (Cf. A., 1940, I, 413.) F. L. U.

Sodium chlorite. Properties and reactions.— See B., 1940, 735.

Friction as an indicator in titration. R. E. D. CLARK (J.S.C.I., 1940, **59**, 216—217).—Alkalis (using at least one protein surface) in acid–alkali titrations and soap or Na alginate in determinations of the hardness of water show their presence when in excess by a sudden increase in the lubricating properties of the solution. By means of a simple apparatus employing a synchronous motor and a rotating wheel, around which a piece of thread is passed, end-points in these titrations are rendered directly visible by the movement of a pointer.

Fischer volumetric determination of water.— See B., 1940, 744.

Determination of total water-soluble chlorides in petroleum.—See B., 1940, 718.

Fluorescence analysis. IV. α-Naphthaflavone as a fluorescence indicator in iodometry and bromometry. H. GOTÔ (Sci. Rep. Tôhoku, 1940, **29**, 1—8; cf. A., 1940, I, 370).—The appearance, on removal of free I or Br, of a blue, ultra-violet-excited fluorescence of α-naphthaflavone can be used to determine the end-point of titrations with I or Br. Performance is satisfactory for $I-Na_2S_2O_3$ and $As_2O_3-KBrO_3$ titrations in presence of coloured ions, *e.g.*, Cr^{+++}. The effect of the addition of protective colloid has been studied. O. D. S.

Influence of protective colloids on the transition point of adsorption indicators. I. Iodides

and chlorides. A. Santos Ruiz and R. Portillo (Anal. Fís. Quím., 1940, **36**, 91—94; cf. Fajans and Hassel, A., 1924, ii, 60).—The nature of the colour change and the titre at which it occurs are recorded when 0.1N-KCl or -KI is titrated with 0.1N-AgNO$_3$ in presence of 0.5% uranin or eosin together with 0.5% albumin, sol. starch, agar, fish glue, gum arabic, grenetin, dextrin, casein, Na oleate, saponin, gum tragacanth, carragheen, Na protalbate, or tannin.
F. R. G.

Determination of fluorides in natural waters. R. L. Ford (J. S. African Chem. Inst., 1940, **23**, 47—51).—Direct titration with Th(NO$_3$)$_4$ (Zr–alizarin-S indicator) in the manner described gives results of sufficient accuracy with most types of natural waters. The Willard–Winter distillation method is unnecessarily long and complicated for routine determinations.
L. S. T.

Analysis of oxygen-rich gas mixtures by Haldane's method. H. Becker-Freyseng and H. G. Clamann (Klin. Woch., 1939, **18**, 1274—1275).—A modification of Haldane's apparatus permits the analysis of gas mixtures of very high O$_2$ and CO$_2$ contents.
M. K.

Voltammetric determination of oxygen. I. M. Kolthoff and H. A. Laitinen (Science, 1940, **92**, 152—154).—Current–voltage curves obtained at $25.00°$ with a Pt-wire micro-electrode in various air-saturated buffer solutions (p_H 3—12) show that the diffusion current $\propto$ [O$_2$], but changes $\sim4\%$ per degree with temp. The diffusion coeff. calc. for O$_2$ is 2.38×10^{-5} sq. cm. per sec. at $25°$. Substitution of a rotating electrode for the stationary wire eliminates the interval before a steady current is reached, and increases the magnitude of the measured currents. Hence it can be used for determining traces of O$_2$. The diffusion current is a function of the time of bubbling N$_2$ through the solution. The O$_2$ content of unpurified tank N$_2$ is 0.15%, and that of N$_2$ purified over heated Cu, 0.02%. No trace of O$_2$ could be detected 10 min. after 0.1 g. of Na$_2$SO$_3$ was added to 100 ml. of 0.1N-KCl.
L. S. T.

Determination of total sulphur in coal and coke.—See B., 1940, 717.

Determination of nitrates in waters and sewage.—See B., 1940, 766.

Analysis of mixtures of helium, oxygen, and nitrogen by determining velocity of sound. W. B. Dublin, W. M. Boothby, H. O. Brown, and M. M. D. Williams (Proc. Staff Mayo Clin., 1940, **15**, 412—416; cf. A., 1940, I, 134).
H. H. K.

Potentiometric analysis of galvanic silver baths.—See B., 1940, 742.

Electrolytic determination of zinc by use of a buffer solution. S. Yatagawa (J. Soc. Chem. Ind. Japan, 1940, **43**, 173B).—1.25 g. of borax and 6 g. of HCO$_3$Na are added to a solution containing >1 g. of Zn as ZnSO$_4$. An amount of HCO$_2$H (90%) which is 0.7 c.c. $>$ that necessary to redissolve the ppt. is added. The solution is diluted to 160 c.c. (p_H 4.3) and electrolysed for 6 hr. at room temp. with a Cu-plated cylindrical Pt cathode and a spiral Pt anode. A current of 0.2 amp. is used. Rotation of the anode is unnecessary.
C. R. H.

Rapid determination of the metal content of cadmium[-plating] baths.—See B., 1940, 742.

Volumetric determination of lead in screw-brass and similar alloys.—See B., 1940, 741.

Manometric micro-determination of copper.—See A., 1940, III, 779.

Qualitative semimicro-analysis with reference to Noyes and Bray's system. Tantalum and tungsten groups. (Miss) C. C. Miller and A. J. Lowe (J.C.S., 1940, 1258—1263).—A modified Noyes and Bray method for separating the Ta and W groups is used in an analytical scheme for the separation of the members of each group. In this modified method the elements, as sulphates, are boiled with 7N-NaOH. The insol. portion consists of Ta, Nb, Zr, Ti, Bi, and Sb (part) as oxides or hydroxides, elementary Te (part), and traces of Sn. The sol. portion contains Na$_2$WO$_4$, Na$_2$MoO$_4$, Na$_2$TeO$_3$, Na$_3$VO$_3$, and Na$_3$PO$_4$, and complex salts of Sb (part), Sn, Pb, and small proportions of Nb and Ta. The two groups are further separated by well-known modern methods, the Ta-group separation being based on Schoeller's method. The scheme is applicable to mixtures containing >50 mg. of the combined metals and containing 0.25—50 mg. of Sb, Sn, and PO$_4'''$, 0.25—10 mg. of Mo, Te, Ti, W, and Zr, 0.5—10 mg. of Ta and Nb, and minor amounts of V (0.25—2 mg.) and Bi (0.25—0.5 mg.).
C. R. H.

Qualitative semimicro-analysis with reference to Noyes and Bray's system. Gold group. (Miss) C. C. Miller and A. J. Lowe (J.C.S., 1940, 1263—1266).—The separation of the Au group incorporates Noyes and Bray's method for the initial separation of Au and Hg and Gilchrist and Wicher's method (cf. A., 1936, 180) for the separation of Pt from Pd, Rh, and Ir. Further separation is continued by means of various modern reagents. The scheme is applicable to mixtures containing >50 mg. of the combined metals and containing 0.25—50 mg. of Hg, 0.25—10 mg. of Au, Pd, and Pt, and 0.25—2 mg. of Ir and Rh.
C. R. H.

Heats of organic reactions. IX. New calorimeter and the denaturation of methæmoglobin by alkali. J. B. Conn, G. B. Kistiakowsky, and R. M. Roberts (J. Amer. Chem. Soc., 1940, **62**, 1895—1905).—Using a calorimeter suitable for studying liquid-phase reactions, the irreversible denaturation of methæmoglobin (I) in aq. KOH (p_H ~9—12) has been investigated at $25°$. Denaturation of (I) at p_H 10—12 is measurably fast; heat is initially absorbed but towards the end of the reaction heat is evolved. The speed of the reaction increases as p_H is increased. The precipitability of (I) at the isoelectric point does not accurately measure the amount of denaturation. The process of denaturation is very complex. At const. p_H the heat of denaturation (ΔH) of (I) is ~100 kg.-cal. and with a const. quantity of KOH in solution ΔH is 138 ± 14 kg.-cal. per mol.
W. R. A.

Magnetic cooling : production and measurement of temperatures below $1°$ K. C. F.

Squire (J. Appl. Physics, 1940, **11**, 232—240).— Experimental and theoretical research on the production and measurement of low temp. by introducing paramagnetic substances into a strong magnetic field is reviewed and discussed. J. W. S.

Constant-temperature control apparatus, utilising a special type of voltage regulator. J. S. Blair (J. Sci. Instr., 1940, **17**, 203—208).—Two circuits for regulating the energy input from fluctuating voltage mains to furnaces etc. are described. The input voltage is varied between two controlled limits, the voltage being automatically maintained at the lower voltage for a longer (or shorter) time than at the higher voltage when the mains voltage rises (or falls). With this control the fluctuations in a furnace at 1000° should not be > external temp. changes. C. R. H.

High-sensitivity radiation pyrometer. N. E. Dobbins, K. W. Gee, and W. J. Rees (Trans. Ceram. Soc., 1940, **39**, 253—257).—The instrument consists of a lens system which throws an image of the hot object on a photo-electric cell device, and has a sensitivity of 0·5—1° at 2000°. The instrument was used to obtain heating curves for Cr_2O_3 and Cr_2O_3–SiO_2 mixtures up to 2000°. J. A. S.

Sources of error in determination of double refraction. P. Aloisi (Period. Min., 1936, **7**, 249—255; Chem. Zentr., 1937, i, 4668).—Errors arise from variation in the thickness or hardness of the specimen, defects in the micrometer screw or objective, inaccurate focussing, or incorrect n vals. for the mineral and immersion medium. A. J. E. W.

Barrier-layer [photo-]cells in microphotometry. A. E. Sandström (Ark. Mat. Astron. Fys., 1936, **B**, **25**, No. 18, 1—4; Chem. Zentr., 1937, i, 4536).—Accurate proportionality between measured intensity and incident light flux has been confirmed by test measurements. The results are reproducible, even after continuous illumination of the cell for 12 hr. The cell current should be <0·01 μa. A. J. E. W.

High-dispersion spectrograph for the ultraviolet. A. Ionescu (Rev. Opt. théor. instr., 1936, **15**, 298—304; Chem. Zentr., 1937, i, 4267).—The auto-collimating quartz-prism spectrograph described covers the λ range 2000—7000 A. with 12 24-cm. spectrograms. The dispersion is 0·52—2·6 A. per mm. at 2100—3680 A. A. J. E. W.

Focal isolation monochromator for the Schumann region. A. B. F. Duncan (Rev. Sci. Instr., 1940, **11**, 260—261).—A fluorite vac. monochromator for the region 1300—1900 A. is described. Lines in the N_2 arc spectrum were isolated in 85% purity, with intensity of the 1742-1745 A. doublet ~1 × 10^{13} quanta per sec. O. D. S.

Photo-electric colorimeter–fluorimeter. D. K. Froman and W. D. McFarlane (Canad. J. Res., 1940, **18**, **B**, 240—245).—The colorimeter is of the compensating two-photo-cell type and may be used as a fluorimeter by changing the lamp and filters. D. F. R.

Electronic relay for heat control. A. C. Hall and L. J. Heidt (Science, 1940, **92**, 133—134).—The

circuit described controls the bath temp. to 0·02°, and requires a 115-v. a.c. or d.c. power source. L. S. T.

Small-scale electrodialysis cell. H. B. Collier (Canad. J. Res., 1940, **18**, **B**, 252—254).—The solution is enclosed by two concentric Cellophane sacs, 18 and 27 mm. diameter, separating the anode (25 × 50-mm. Pt foil) and cathode (Hg) compartments through which H_2O is circulated. Rapid dialysis may be effected, 98% of a 2·3м-$(NH_4)_2SO_4$ solution being removed after 3 hr. at 50 ma. D. F. R.

Apparatus for detecting pyro-electric effect in crystals. R. G. Wood and C. H. McCale (J. Sci. Instr., 1940, **17**, 225—226).—The crystal is held in any desired orientation by two flat springs, one being earthed and the other connected to a quadrant electrometer. The leads from the springs are supported and insulated by a S plug in an earthed brass tube. Deflexions obtained with picryl-p-toluidine and s-$C_6H_3Ph_3$ are given. D. F. R.

Electrodes for potentiometric and conductometric titrations. H. Gotô (Sci. Rep. Tôhoku, 1940, **29**, 9—21).—Convenient electrodes for potentiometric titrations were constructed from a Pt wire dipping into electrolyte solution contained in a glass micro-filter tube, a glass tube with sintered end, a tube with a ground-glass plug, or a tube with a glass stopcock. Platinised and Au-plated glass electrodes are convenient for conductometric titrations in solutions containing org. solvents. O. D. S.

Ionisation gauge circuit. R. M. Bowie (Rev. Sci. Instr., 1940, **11**, 265—267).—A circuit suitable for industrial use with the gauge of Morse and Bowie (A., 1940, I, 235) is described. O. D. S.

Interval meter and its application to studies of Geiger counter statistics. R. I. Driscoll, M. W. Hodge, and A. Ruark (Rev. Sci. Instr., 1940, **11**, 241—250).—An instrument, by means of which the no. of intervals between discharges in a Geiger counter which are > any given time can be measured and compared with the total count, is described. For two A-filled counters excited by γ-rays at counting rates from 0·9 to 3·0 counts per sec. the instrument gave results agreeing with statistical theory. Significant deviations from theory were observed for a H_2-filled counter excited with γ-rays or light at rates from 1·9 to 4·5 counts per sec. O. D. S.

Grid to reduce operating voltage in Geiger-Mueller counters. S. A. Korff and W. E. Ramsey (Rev. Sci. Instr., 1940, **11**, 267—269). O. D. S.

Micro-analysis of gases. R. Spence (J.C.S., 1940, 1300—1303).—A new apparatus for the const.-vol. micro-analysis of gases consists essentially of a loop of capillary tubing in which an absorbent removes a constituent of the gas. The loop is fitted with non-return valves which enable the gas to be circulated over the absorbent. After withdrawing the gas into a micro-burette and measuring the pressure change, the gas can be returned, if necessary, to a second loop containing a different absorbent. C. R. H.

Microchemical kits. R. D. Cool (J. Chem. Educ., 1940, **17**, 283—286).—Portable arrangements for reagents are described.   L. S. T.

Portable laboratory for the microscopist. G. Weingarten (J. Chem. Educ., 1940, **17**, 293—295).— A portable arrangement of apparatus for performing qual. micro-analysis is described.   L. S. T.

Packed fractionating columns and the concentration of isotopes. K. Cohen (J. Chem. Physics, 1940, **8**, 588—597).—Theoretical. The behaviour of isothermal packed fractionating columns is deduced from their differential equation. The rate of approach to equilibrium and the relation between rates of production and fractionation are studied with reference to the separation of isotopes.   W. R. A.

Small-scale production of liquid nitrogen. C. T. Lane and W. W. Watson (Rev. Sci. Instr., 1940, **11**, 272).—Apparatus is described for the prep. of liquid N_2 by condensation at 40 lb. pressure using liquid-air cooling.   O. D. S.

Micro-Kjeldahl apparatus. H. Hoch (Biochem. J., 1940, **34**, 1209—1210).—With the apparatus described 50—150 μg. of N can be determined with an accuracy of ±3%.   P. G. M.

Apparatus for coating surfaces with magnesium oxide. K. R. May (J. Sci. Instr., 1940, **17**, 231).   D. F. R.

Separation of liquid mixtures by thermo-diffusion. H. Korsching and K. Wirtz (Ber., 1940, **73**, [*B*], 249—269).—Mainly a detailed account of work reported previously (A., 1939, I, 282, 483; 1940, I, 35; Clusius and Dickel, A., 1939, I, 224). The theory of the thermo-diffusion effect in liquids (cf. A., 1939, I, 470; Debye, A., 1940, I, 135) is re-viewed and discussed. Three types of apparatus are described, in each of which the length of the diffusion path is 10 cm. Two are of metal; in one the heated and cooled surfaces are parallel flat plates, and the other consists of concentric sleeves, between which diffusion occurs in an annular space. The third, less efficient, model is of glass, and resembles a Liebig condenser with an additional, heated inner tube. Small reservoirs are provided at the top and bottom of the diffusion space. Methods of using the apparatus in stage-by-stage separations are suggested. The separation of various typical mixtures, which cannot be predicted *a priori*, is examined. The practical utility of the method is illustrated by a separation of nearly pure $n\text{-}C_6H_{14}$ from petroleum distillates, and reduction of the H_2O content of EtOH from 4·4 to 0·2%, and of the thiophen content of C_6H_6 from 1·2 to ~0·015% (3, 1, and 4 stages, respectively). The applicability of the method to separations in solution is also demonstrated [with L. W. Masch] by a partial separation of cholestatrienone dibromide from cholestenone in C_6H_6 solution.   A. J. E. W.

Formation of protective films. L. H. Callendar (Nature, 1940, **146**, 304; cf. A., 1940, I, 369).
                                        L. S. T.

Determination of distribution of crystallites in fibres by direct and indirect methods. Y. Go (Bull. Chem. Soc. Japan, 1940, **15**, 239—258).—A type of *X*-ray camera designed for direct determination of the distribution of crystallites in fibres by using reflexions from the meridian plane ("diatropic reflexions") is described. Formulæ used in determining the distribution indirectly are discussed and the results compared.   F. J. G.

Samuel Guthrie. F. H. Getman (J. Chem. Educ., 1940, **17**, 253—259).   L. S. T.

Geochemistry.

Physico-chemical analysis and the annual cycles of salt lakes. N. S. Kurnakov, I. B. Feigelson, and A. G. Bergman (Ann. Sect. Anal. Phys.-Chim., 1940, **12**, 189—212).—The results of determinations at frequent intervals from 1932 to 1938 of the NaCl, $MgCl_2$, and $MgSO_4$ contents of L. Elton water are expressed by means of "cyclo-chronograms" (curves connecting concn. of a given salt with temp., date, and [NaCl]). (Cf. A., 1940, I, 413.)
                                        R. T.

Growth phenomena in diamond. H. W. Lindley (Fortschr. Min., 1937, **21**, 71—72; Chem. Zentr., 1937, i, 4759).—Microscopical examination of polished South-west African diamonds generally reveals distinct crystal zones (mimetic overgrowths), which are detected by changes of *n* and double refraction, and in some cases by differences in fluorescence. Six octahedral and eight tetrahedral zones have been observed in an apparently homogeneous crystal; the boundaries are shown to have developed during growth of the crystal.   A. J. E. W.

Zircon. R. Brauns (Deut. Goldschmiede-Ztg., 1937, **40**, 63—64; Chem. Zentr., 1937, i, 4760).— Three types of colourless zircon are distinguished; they are initially (*a*) brown (jacinth), (*b*) rose-red (decolorised by heating at 500° and in sunlight, respectively), and (*c*) colourless. On exposure to radiation from Ra, in which all three types phosphoresce, (*a*) quickly regains its colour, whilst (*b*) first becomes rose-red and then assumes a jacinth shade; (*c*) is unaffected. Zircon contains traces of Th and meso-Th and dispersed colour centres (Fe, Mn).
                                        A. J. E. W.

Zircon. J. W. Howard (J. Chem. Educ., 1940, **17**, 265—267).—Sources, composition, properties, and uses of zircon are discussed.   L. S. T.

Occurrence of barite in an iron ore deposit in Namaqualand. M. Mathias (Trans. Roy. Soc. S. Africa, 1940, **28**, 207—217).—The barite forms the principal gangue mineral of the magnetite deposit at "Zuurwater" farm, Namaqualand. A chemical analysis of the magnetite–barite rock is given, and its origin discussed.   L. S. T.

Sillimanite–corundum rock: a metamorphosed bauxite in Namaqualand. C. B. Coetzee

(Trans. Roy. Soc. S. Africa, 1940, **28**, 199—205).— The paragenesis of the rock, which has SiO_2 26·01, TiO_2 5·55, Al_2O_3 66·30, Fe_2O_3 0·41, FeO 0·54, MnO 0·01, CaO none, MgO none, $K_2O + Na_2O$ 0·09, H_2O+ 1·00, H_2O- 0·08, total 99·99%, is described. It originated probably by the static metamorphism of a dominant aluminous sediment, probably a bauxite.   L. S. T.

Development of the mineral deposit at Mawchi [Burma] as determined by its geology and genesis. G. V. HOBSON (Trans. Min. Geol. Met. Inst. India, 1940, **36**, 35—78).—General geology is described, and genesis of the ore-body is discussed in detail. The mineralisation of the granite, and the Sn–W ratio, are also discussed.   L. S. T.

Sulaipat iron mine. F. G. PERCIVAL (Trans. Min. Geol. Met. Inst. India, 1940, **36**, 26—32).— Mainly descriptive. The ore is massive and dense with often >69% of Fe. The P content is low. Production data are recorded.   L. S. T.

Isomorphous replacement and superlattice structures in the plagioclase felspars. S. H. CHAO and W. H. TAYLOR (Proc. Roy. Soc., 1940, **A**, **176**, 76—87).—X-Ray analysis shows that the albite structure extends from the pure soda-felspar to at least 22% lime-felspar, the unit cell being approx. $8 \times 13 \times 7$ A., and containing 4 mols. of $NaAlSi_3O_8$ or the equiv. when (CaAl) replaces (NaSi). There is a similar range of isomorphism near pure lime-felspar, $CaAl_2Si_2O_8$, with the anorthite structure $8 \times 13 \times 14$ A. The intermediate plagioclases seem to consist of alternating sheets of the albite and anorthite structures.   G. D. P.

Hydromagnesite. M. FENOGLIO (Period. Min., 1936, **7**, 257—284; Chem. Zentr., 1937, i, 4760; cf. A., 1937, I, 205).—A crystallographic, optical, and X-ray study of specimens from various sources indicates that hydromagnesite has rhombic-bipyramidal symmetry with a simple Γ-lattice, space-group D_{2h}^1. The formula $5MgO,4CO_2,5H_2O$ is confirmed.   A. J. E. W.

Synthesis of alumopharmacosiderite ; formula and structure of pharmacosiderite. G. HÄGELE and F. MACHATSCHKI (Fortschr. Min., 1937, **21**, 77—78; Chem. Zentr., 1937, i, 4760).—A paste prepared by addition of K_2HAsO_4 to conc. aq. $Al_2(SO_4)_3$ is heated at 250° in a sealed tube; *alumopharmacosiderite* (I) remains as isotropic cubes after treating the product with HCl on the H_2O-bath. The X-ray powder diagrams for (I) and pharmacosiderite, $Fe_3(AsO_4)_2(OH)_3,5H_2O$, are almost identical, with a 7·75, 7·94 A., respectively. The formula $Al_3(AsO_4)_2(OH)_3,5H_2O$ agrees with analyses of (I), but requires $1\frac{1}{4}$ mols. in the unit cell; $Al_5As_3O_{12}(OH)_6,6H_2O$ gives one mol. per cell, space-group T_d^1. The continuous three-dimensional structure contains AsO_4 tetrahedra and $AlO_3(OH)_3$ octahedra, with $Al(H_2O)_6$ octahedra in some of the large lattice spaces.   A. J. E. W.

Structural relations between sulphates and phosphates or arsenates, particularly between

gypsum and pharmacolite. B. GOSSNER (Fortschr. Min., 1937, **21**, 34—36; Chem. Zentr., 1937, i, 4760).—The morphological axial ratios for gypsum (I) and pharmacolite $(CaHAsO_4,2H_2O)$ (II) are $a : b : c = 0.6895 : 1 : 0.4132$ and $0.6236 : 1 : 0.3548$, with β 98° 58' and 96° 36', respectively. X-Ray measurements show that a comparison is possible if new axes are assigned to (II), such that $h' = -l$, $2k' = k$, $2l' = h$, $a' : b' : c' = 2c : b : \frac{2}{3}a = 0.7096 : 1 : 0.4157$. (I) and (II) have a 10·47, 10·97; b 15·15, 15·40; c 6·28, 6·29 A. A structural similarity between hamlinite, alurcite, and bendantite is noted.   A. J. E. W.

Geology, mineralisation, and placers of Tarryall and Beaver Creeks, Park Co., Colorado. Q. D. SINGEWALD (Econ. Geol., 1939, **34**, 132).   L. S. T.

Structural relations of chromite deposits. E. SAMPSON (Econ. Geol., 1939, **34**, 130).—Five structural types of deposit are proposed, and localities in which these types occur are named.   L. S. T.

Quicksilver deposits of the Terlingua region, Texas. C. P. ROSS (Econ. Geol., 1939, **34**, 125).— The region contains Cretaceous strata, largely calcareous, cut by many intrusions. Many of the lodes are near the base of the impervious Del Rio clay. The solutions penetrated only along open passageways. The Hg was introduced probably in alkali sulphide solutions containing free alkali, from which most of the other original constituents of the solutions had separated earlier. Pptn. resulted mainly by mixing with ground H_2O containing H_2CO_3.   L. S. T.

Geology and development of the Polaris-Taku [British Columbia] mine. D. C. SHARPSTONE (Econ. Geol., 1939, **34**, 127—128).—As ores occur in a complex system of faulted veins within volcanic greenstone walls; >200 tons are mined daily. The mineralisation is Au, arsenopyrite (I), pyrite, and minor stibnite in quartz and carbonates. Au and (I) were deposited early, and are intimately associated.   L. S. T.

Bravoite from Mill Close mine, Derbyshire. F. A. BANNISTER (Min. Mag., 1940, **25**, 609—614).— Nodular bravoite has the pyrite structure with unit-cell edge a 5·49 A., and analysis (M. H. HEY) gave Fe 29·30, Ni 16·69, Co trace, S 53·40; d 4·82. A granular mixture of bravoite and pyrite gave for the former a 5·57 A., suggesting a second type of bravoite containing about 28% Ni. These vals. lie between those for pyrite (a 5·49 A.) and for artificial NiS_2 (a 5·74 A.).   L. J. S.

[Alkali-containing] earth. III. Water-soluble matter of alkaline earth distributed in Pinkiang province. K. KAWASE and S. ANZO (Rep. Inst. Sci. Res., Manchoukuo, 1940, **4**, 119—139).—Analyses of the H_2O-sol. matter in soil from the alkali regions of Pinkiang indicate that the surface soil contains the largest quantities of total sol. matter, and that the relative concns. of anions follow the order $HCO_3' > SO_4'' > Cl' > CO_3''$.   J. W. S.