

JANUARY, 1941.

## I.—SUB-ATOMICS.

**Zeeman effect of chrome alum.** J. H. Van Vleck (*J. Chem. Physics*, 1940, 8, 787—789).—Theoretical. The Zeeman patterns of the absorption lines of Cr alum near  $15,000\text{ cm}^{-1}$ , observed by Spedding and Nutting (A., 1935, 1052), indicate that these lines are inter-system combinations. J. W. S.

**Energy levels of chrome alum.** R. Finkelstein and J. H. Van Vleck (*J. Chem. Physics*, 1940, 8, 790—797).—Theoretical. The energy levels for the  $d^3$  configuration of the  $\text{Cr}^{3+}$  ion in Cr alum are calc. and discussed (cf. preceding abstract). J. W. S.

**Temperature dependence of the work function of tungsten from measurement of contact potentials by the Kelvin method.** J. G. Potter (*Physical Rev.*, 1940, [ii], 58, 623—632).—The Kelvin method is adapted for measurements between filaments in vac. Measurements between a heated and a cool W filament indicate an increase in  $w$ , the work function of W, with temp., of  $6.3 \times 10^{-5}$  v. per degree, which appears to be comparatively independent of the degree of surface contamination. The effect is distinguished from changes in  $w$  due to temp. variations in contaminating layers tending to obscure the true temp. coeff. The temp. effect probably resides primarily in the thermodynamic potential of the electrons inside the metal and not in the potential barrier at the surface. The coeff. obtained eliminates the discrepancy between the experimental val. of  $A$  in the Richardson equation and the theoretical factor of 120 without introducing a reflexion coeff. N. M. B.

**Electron scattering in bromine gas.** C. H. Shaw and T. M. Snyder (*Physical Rev.*, 1940, [ii], 58, 600—602).—Calculations are made on the angular dependence of electron scattering in Br gas with the scattering phases previously obtained (cf. A., 1940, I, 305). For the lower energies it is essential to include at. polarisation in the calculations of the phase defects. Results are compared with experimental work by Arnot (cf. A., 1934, 577). N. M. B.

**Scattering of fast electrons in helium.** J. B. H. Kuper and E. Teller (*Physical Rev.*, 1940, [ii], 58, 602—603).—Neglect of inelastic scattering explains the failure of the quantum theory of elastic scattering to account for experimental data for 50—80-kv. electrons in He (cf. A., 1938, I, 425). Computation of the cross-sections including inelastic and elastic collisions by an approx. method gives satisfactory results. N. M. B.

**Secondary emission from films of platinum on aluminium.** P. L. Copeland (*Physical Rev.*, 1940, [ii], 58, 604—607; cf. A., 1939, I, 441; Hastings, A., 1940, I, 276).—Experimental results indicate a direct proportionality between the primary energy (up to 800 e.v.) and the max. depth of origin of the secondaries. These depths accord with the vals. to be expected from existing theories. The max. depth within the target influencing the secondary emission increases more rapidly for primary energies  $> 800$  e.v. than for those below. N. M. B.

**Relative secondary electron emission due to He, Ne, and A ions bombarding a hot nickel target.** (Miss) M. Healea and (Miss) C. Houtermans (*Physical Rev.*, 1940, [ii], 58, 608—610).—The no. of electrons emitted per positive ion from a degassed Ni target was measured. For He (450—1650 e.v.) the emission increase was 49—107%; for Ne (900—1275 e.v.) the increase was 43—57%; for A (680—1480 e.v.) it was 11—18%. These results disagree with those of Hill (cf. A., 1939, I, 230) but confirm those found for  $\text{H}_2^+$  and  $\text{D}_2^+$  (cf. *ibid.*, 394) in showing a smaller emission for the heavier ion at the same energy. The % of positive ions reflected increased with the energy of the primary ions and was smaller for the heavier ions. N. M. B.

**Precise determination of the fine structure constant.** R. F. Christy and J. M. Keller (*Physical Rev.*, 1940, [ii], 58, 658).—Mathematical. Calculations based on the theoretical behaviour of the X-ray spin doublet splitting for elements of high at. no. lead to the val.  $1/a = hc/2\pi e^2 = 136.95 \pm 0.13$ . N. M. B.

**Values of  $e$ ,  $e/m$ ,  $h/e$ , and  $a$ .** R. T. Birge (*Physical Rev.*, 1940, [ii], 58, 658—659).—With the best available data, the val. of  $h/e$  calc. from the Rydberg const. formula is  $(1.37929 \pm 0.00040) \times 10^{-17}$ , contrasted with the observed val.  $1.3765 \pm 0.0003$ . The new val. of  $1/a$  (cf. preceding abstract) accords with that calc. from the Rydberg const. formula, indicating that the  $h/e$  discrepancy lies in the observed val. N. M. B.

**Angular distribution of fast neutrons scattered by hydrogen, deuterium, and helium.** H. H. Barschall and M. H. Kanner (*Physical Rev.*, 1940, [ii], 58, 590—596).—The angular distribution of  $d$ - $d$  neutrons scattered by H, D, and He was measured by observing the energy distribution of the recoil particles in an ionisation chamber. Curves show that the scattering in H and D is essentially isotropic in the angular interval examined. In He, collisions with small energy transfer were more frequent than large-angle scattering. Estimates of the abs. differential scattering cross-section of He are given. N. M. B.

**Steady-state diffusion under conditions of generalised source and incident current distributions.** E. A. Schuchard and E. A. Uehling (*Physical Rev.*, 1940, [ii], 58, 611—623).—Mathematical. The method of Laplace transformations is extended to the more general case of neutron diffusion in half-infinite media containing source distributions, and an exact expression for the emergent current distribution is obtained. N. M. B.

**Relative cross-sections of the  $(n, \alpha)$  and  $(n, p)$  reactions produced by fast neutrons.** T. Amaki and A. Sugimoto (*Physical Rev.*, 1940, [ii], 58, 659).—Approx. cross-sections, calc. from measured intensities of the induced activities, are reported for 17 reactions induced by bombardments with neutrons from Li or Be. N. M. B.

**Carbon isotopes of mass 10 and 11.** L. A. Delsasso, M. G. White, W. Barkas, and E. C. Creutz (*Physical Rev.*, 1940, [ii], 58, 586—590; cf. A., 1939, I, 505).— $^{11}\text{C}$  was produced by the two new reactions  $^{11}\text{B}(p, n)^{11}\text{C}$  and  $^{14}\text{N}(p, \alpha)^{11}\text{C}$ . The upper limit of the positron spectrum of  $^{11}\text{C}$ , measured by a cloud chamber, was  $0.95 \pm 0.03$  Me.v. A new isotope,  $^{10}\text{C}$ , of period  $8.8 \pm 0.8$  sec., was produced by the reaction  $^{10}\text{B}(p, n)^{10}\text{C}$ . The upper limit of the positron spectrum was  $3.36 \pm 0.1$  Me.v. The relation of the measurements to isobaric splitting and properties of light nuclei is discussed. N. M. B.

**Calcium metaphosphate as a target for bombardment of phosphorus by high-voltage ion beams.** D. E. Hull and J. H. Williams (*Rev. Sci. Instr.*, 1940, 11, 299).— $\text{Ca}(\text{PO}_3)_2$  is a more suitable substance than amorphous P, or  $\text{P}_2\text{O}_5$ , for use as a target in investigations of the bombardment of P, as its v.p. is not high at the temp. produced by the ion beam. The method of attachment of  $\text{Ca}(\text{PO}_3)_2$  to Pt foil to form the target is described, and a chemical method of removing it after the bombardment in order to examine the radioactive P produced is outlined. A. J. M.

**( $d, 2n$ ) Reaction in copper.** R. S. Livingston and B. T. Wright (*Physical Rev.*, 1940, [ii], 58, 656).—Cu foils were bombarded by 16-Me.v. deuterons from a cyclotron and a strong activity attributed to  $^{63}\text{Cu}(d, 2n)^{62}\text{Zn}$  (38 min.) was observed. Activity-cross-section curves for the formation of  $^{63}\text{Zn}$  and of  $^{64}\text{Cu}$  (12.8 hr.) are given and discussed. The calc. 2

threshold for the ( $d, 2n$ ) reaction is  $\sim 7$  and the observed val.  $\sim 7.5$  Me.v. N. M. B.

**Cloud-chamber studies of fission fragment tracks.** K. J. Broström, J. K. Boggild, and T. Lauritsen (*Physical Rev.*, 1940, [ii], 58, 651—653; cf. Corson, A., 1939, I, 234).—With a large Wilson chamber containing gases at  $\sim 5$  cm. pressure, photographs of tracks of fission fragments show branching by nuclear collision many times in a single track. An analysis of measurable branches indicates a range-velocity relation different from that for light particles. In A, deviations are very marked in the first part of the range, thereafter decreasing; in H<sub>2</sub> the curvatures are smaller. Range-velocity curves are given. N. M. B.

**Scattering and stopping of fission fragments.** N. Bohr (*Physical Rev.*, 1940, [ii], 58, 654—655).—A mathematical consideration of the results of Broström (cf. preceding abstract). Differences between the fission tracks and those of protons and  $\alpha$ -particles are shown to be due to the high charge and mass of the fission fragments, which imply that nuclear collisions play a much greater part in the phenomenon. N. M. B.

**Fission products of uranium by fast neutrons.** Y. Nishina, T. Yasaki, K. Kimura, and M. Ikawa (*Physical Rev.*, 1940, [ii], 58, 660—661; cf. A., 1940, I, 341).—Pd after bombardment by fast neutrons gave a decay curve showing 17-hr. and 26-min. periods. It was shown by separation and pptn. of Ag that the 17-hr. Pd must be <sup>112</sup>Pd and gives rise to <sup>112</sup>Ag (3.5 hr.). N. M. B.

**Deuteron bombardment of silver.** R. S. Krishnan (*Proc. Camb. Phil. Soc.*, 1940, 36, 500—506; cf. A., 1939, I, 592).—Deuteron bombardment of Ag gives radioactive isotopes with periods 2.4 min., 26 min., and 225 days isotopic with Ag, and 6.7 hr. and 1 year isotopic with Cd. Energy-yield curves have been determined. L. J. J.

**Deuteron bombardment of heavy elements. I. Mercury, thallium, and lead.** R. S. Krishnan and E. A. Nahum (*Proc. Camb. Phil. Soc.*, 1940, 36, 490—499).—Hg, Tl, Pb, and Bi bombarded with 9-Me.v. deuterons, give radioactive isotopes with periods 5.5 min., 48 min., 36 hr., 60 days; 4.4 min., 10.5 hr., 44 hr., 13 days; 10.25 min., 2.75 hr., 54 hr.; and 18 hr. and 6.35 days, respectively. The 10.25-min. Pb emits positrons. Absorption data are recorded for the radiations. L. J. J.

**Chemistry within the atom.** S. C. Lind (*Science*, 1940, 92, 227—231). L. S. T.

**Air mass effect on cosmic-ray intensity.** D. H. Loughridge and P. F. Gast (*Physical Rev.*, 1940, [ii], 58, 583—585; cf. A., 1940, I, 54; Nishina, *ibid.*, 309).—Observations over a range of atm. conditions on shipboard establish an effect on cosmic-ray intensity at the boundaries of different types of air masses. The effect is of the Blackett seasonal-variation type. N. M. B.

**Fine structure pattern of cosmic rays at Mexico City.** E. J. Schremp and A. Baños, jun. (*Physical Rev.*, 1940, [ii], 58, 662—663; cf. Johnson, A., 1935, 1297).—Preliminary results of a search for fine structure analogous to that found elsewhere by Ribner (cf. A., 1940, I, 54) and Cooper (cf. *ibid.*, 400) are reported. N. M. B.

**Measurement of cosmic rays at Agra and Kodaikanal.** A. K. Das and M. Salaruddin (*Indian J. Physics*, 1940, 14, 191—205).—Mean intensity vals. of cosmic rays at Agra and Kodaikanal are  $1.545 \pm 0.007$  and  $2.333 \pm 0.010$  pairs of ions per c.c. per sec. respectively and the absorption coeff. is 0.202 per m. of H<sub>2</sub>O. Diurnal variation of intensity has been studied, but no correlation has been established between intensity variation and sun-spot nos. or flocculi figures. W. R. A.

**Ultra-soft components of cosmic rays. II.** G. P. S. Occhialini and M. Schönberg (*Ann. Acad. Brasil. Sci.*, 1940, 12, 197—202).—The energy of photons in small showers is measured. F. R. G.

**Penetrating cosmic-ray showers.** P. A. Pompeia, M. D. de Souza Santos, and G. Wataghin (*Ann. Acad. Brasil. Sci.*, 1940, 12, 229—230).—Some soft radiation is shown to be associated with the penetrating core of the shower. Measurements are recorded showing the existence underground of groups or pairs of associated penetrating particles. F. R. G.

**Casimir's method of spin summation in the case of the meson.** S. Sakata and M. Taketani (*Sci. Papers Inst. Phys. Chem. Res. Tokyo*, 1940, 38, 1—11).—Theoretical. J. W. S.

**Scattering of neutral mesons.** F. Booth and A. H. Wilson (*Proc. Camb. Phil. Soc.*, 1940, 36, 446—453).—According to the quantised theory scattering of neutral mesons by protons due to the  $g_1$  (point charge) interaction is  $\ll$  that for charged mesons, but the anomaly due to the  $g_2$  (dipole) interaction remains. L. J. J.

**Electrostatic dipole moment of a nucleus in the meson theory.** S. T. Ma (*Proc. Camb. Phil. Soc.*, 1940, 36, 438—440).—Emission and absorption of a meson gives rise to an electrostatic nuclear dipole moment, which is evaluated. L. J. J.

**Deviation from the Coulomb law for the proton.** S. T. Ma (*Proc. Camb. Phil. Soc.*, 1940, 36, 441—445).—Deviations from the Coulomb law calc. on the basis of Heitler's hypothesis of higher states for nuclear particles (A., 1940, I, 91) are shown to be  $<$  those calc. on the basis of current meson theory. L. J. J.

**Theoretical atomic distribution curve for liquid argon at 90° K.** G. S. Rushbrooke (*Proc. Roy. Soc. Edin.*, 1940, 60, 182—191).—Mathematical. The position, height, and shape of the first max. in the at. distribution curve of liquid A are calc. on the basis of Lennard-Jones and Devonshire's model for the structure of liquid A (A., 1938, I, 352). The shape agrees closely with that of a Wall peak (A., 1939, I, 133). More complete curves, showing two further peaks, are calc. on two alternative hypotheses as to the structure of liquid A. O. D. S.

**Propagation of electromagnetic waves in an ionised medium and the calculation of the true heights of the ionised layers of the atmosphere.** O. Rydbeck (*Phil. Mag.*, 1940, [vii], 30, 282—293).—Theoretical. A. J. M.

## II.—MOLECULAR STRUCTURE.

**Nuclear isotope shift in the spectrum of ZnH.** S. Mrozowski (*Physical Rev.*, 1940, [ii], 58, 597—599).—A study by Fabry-Perot etalon of the structure of lines in the (0, 0) band of the <sup>2</sup>Π<sub>1</sub> → <sup>2</sup>Σ system of ZnH excited in a hollow-cathode tube shows structure, due to Zn isotope effect, for lines near the head of the <sup>o</sup>P<sub>12</sub> branch. The measured shifts are  $>$  those calc. by formulæ for vibrational and rotational isotopic effects and indicate an additional shift, of at least partly nuclear origin,  $\sim 0.007$  cm.<sup>-1</sup> for the consecutive even-mass Zn isotopes. The shifts are  $\sim$  one tenth of, and opposite in direction to, the analogous nuclear shifts in HgH (cf. A., 1940, I, 401). N. M. B.

**Presence of HNC in hydrogen cyanide.** G. Herzberg (*J. Chem. Physics*, 1940, 8, 847—848).—The presence of the weak 2062 cm.<sup>-1</sup> frequency in the Raman spectrum of HCN can be explained quantitatively as due to H<sup>13</sup>CN and does not support the view that traces of HNC are present in HCN (cf. Dadiou, A., 1931, 998). It is inferred that the weak 4.95 μ. band in the infra-red spectrum of saturated aq. HCN is probably not due to HNC (cf. Gordy and Williams, A., 1936, 406). J. W. S.

**Fine structure of the 3.35 μ. band of ethylene.** L. G. Smith (*J. Chem. Physics*, 1940, 8, 798—799).—The rotation structure of the parallel band of C<sub>2</sub>H<sub>4</sub> at 3.35 μ., due to C—H stretching vibration, has been investigated, and the mean of the two large moments of inertia of C<sub>2</sub>H<sub>4</sub> is calc. as  $30.08 \times 10^{-40}$  g.-cm.<sup>2</sup> This val., combined with the val.  $C = 5.70 \times 10^{-40}$  g.-cm.<sup>2</sup> for the small moment, leads to vals. of  $33.20 \times 10^{-40}$  and  $27.50 \times 10^{-40}$  g.-cm.<sup>2</sup> for the large moments of inertia A and B, respectively, in accord with previous results (Badger, A., 1935, 1448). J. W. S.

**Ultra-violet absorption of nitrogen peroxide.** L. Harris, G. W. King, W. S. Benedict, and R. W. B. Pearse (*J. Chem. Physics*, 1940, 8, 765—774).—Analysis of eight discrete and several diffuse absorption bands of NO<sub>2</sub> in the region 2300—2700 Å. indicates that the upper electronic state intervals are 523 and 714 cm.<sup>-1</sup> and the lower state intervals 749 and 1319 cm.<sup>-1</sup> Temp. coeff. measurements indicate that the origin of the system is at 2491 Å. Possibilities of reconciling these frequencies with those derived from the infra-red spectrum are discussed. J. W. S.

**Rotational structure of the ultra-violet bands of nitrogen peroxide.** L. Harris and G. W. King (*J. Chem. Physics*, 1940, 8, 775—784).—The spectroscopic consts. of the 2491 Å. band of  $\text{NO}_2$  have been derived. The N—O distance is 1.28 and 1.41 Å. in the lower and excited states, respectively, whilst the O—N—O angle is  $\sim 154^\circ$  in both states. J. W. S.

**Infra-red absorption of phenol and its halogen derivatives in the region of the second overtone of the OH absorption.** O. R. Wulf and E. J. Jones (*J. Chem. Physics*, 1940, 8, 745—752).—The absorption spectra of  $\text{CCl}_4$  solutions of  $\text{PhOH}$ ,  $\text{C}_6\text{Cl}_2\text{OH}$ , and of the compounds  $o\text{-C}_6\text{H}_4\text{X}\cdot\text{OH}$  and 2 : 4 : 6 : 1- $\text{C}_6\text{H}_2\text{X}_3\cdot\text{OH}$  (X = Cl, Br, or I) have been studied in the region 9600—10,600  $\text{cm}^{-1}$ . As in the region of the first overtone, the *o*-compounds show a small absorption peak in the normal OH position, and a larger peak displaced to lower  $\nu$ , but subsidiary peaks are more pronounced. The displacements of the *cis*-peaks are in the order of the polarisability of the halogen atoms. The variation in the absorption of  $\text{PhOH}$  solutions with concn. indicates that in  $\text{CCl}_4$  it is associated into a series of polymerides. J. W. S.

**Combination frequencies associated with the first and second overtone and fundamental OH absorption in phenol and its halogen derivatives.** O. R. Wulf, E. J. Jones, and (Miss) L. S. Deming (*J. Chem. Physics*, 1940, 8, 753—765).—The absorption frequencies of  $\text{PhOH}$ ,  $\text{C}_6\text{Cl}_2\text{OH}$ , and the compounds  $o\text{-C}_6\text{H}_4\text{X}\cdot\text{OH}$  and 2 : 4 : 6 : 1- $\text{C}_6\text{H}_2\text{X}_3\cdot\text{OH}$  (X = Cl, Br, or I) in the region 7500—8450  $\text{cm}^{-1}$  are interpreted as combination frequencies in which the valency vibration of the OH-group is combined with nuclear frequencies. Some of these combination frequencies underlie the *trans*-peaks of *o*-halogen compounds. A close correspondence exists between the frequencies involved in these combinations and those observed in the far infra-red and Raman spectra. J. W. S.

**Absorption spectra of gaseous methylamine and dimethylamine in the photographic infra-red.** A. P. Cleaves, H. Sponer, and L. G. Bonner (*J. Chem. Physics*, 1940, 8, 784—787).—The absorption spectra of gaseous  $\text{NH}_2\text{Me}$  and  $\text{NHMe}_2$  have been studied in the region 6000—12,000 Å. Bands are observed in both gases at 7940, 9100, and 11,800 Å., in  $\text{NH}_2\text{Me}$  at 9940, 10,070, and 10,330 Å., and in  $\text{NHMe}_2$  at 8045, 10,360, and 10,625 Å. As far as possible the bands are assigned to overtones and combinations of the fundamental N—H and C—H valency vibrations. J. W. S.

**Lattice vibrations of crystals and the corresponding vibrations of their solutions.** II. S. Freed and S. I. Weissman (*J. Chem. Physics*, 1940, 8, 840—842; cf. A., 1940, I, 192).—The absorption spectrum of anhyd.  $\text{EuF}_3$  shows repetitions of the main absorption band at intervals corresponding with a lattice vibration of  $\sim 340 \text{ cm}^{-1}$ , a val.  $>$  that observed in hydrated salts and indicating the greater tightness of binding in the anhyd. crystals. In abs.  $\text{EtOH}$ , anhyd.  $\text{Eu}(\text{NO}_3)_3$  shows vibrational intervals of 210 and 90  $\text{cm}^{-1}$ , whilst  $\text{EuCl}_2$  shows a 165  $\text{cm}^{-1}$  vibration; in  $\text{H}_2\text{O}$ , however, both  $\text{Eu}(\text{NO}_3)_3$  and  $\text{EuCl}_2$  show a frequency of 125  $\text{cm}^{-1}$ . Addition of  $\text{H}_2\text{O}$  to the  $\text{EtOH}$  solutions causes the repetitions to become diffuse. Solutions of  $\text{Eu}$  acetylacetonate in  $\text{C}_6\text{H}_6$  or  $\text{CCl}_4$  show no repetitions of the main absorption band. The theory of the repetitions is discussed. J. W. S.

**Typical colour curves and their application for purity tests in physiological researches.**—See A., 1941, III, 62.

**Photodehydrogenation of sterols.  $\Delta^2$ - $\Delta^4$ -Cholestadiene.**—See A., 1941, II, 11.

**Fluorescence of hydrocarbons and of their mixtures with naphthalene.**—See A., 1941, II, 8.

**Lifetime of fluorescence in diacetyl and acetone.** G. M. Almy and S. Anderson (*J. Chem. Physics*, 1940, 8, 805—814).—Direct measurements with a phosphoroscope and measurements of the diffusion of excited mols. from a beam of exciting illumination indicate that the mean life of fluorescence in  $\text{Ac}_2$  vapour is  $1.65 \times 10^{-9}$  sec. Integration of the absorption coeff. over the band associated with the fluorescence, however, leads to a mean life of  $\sim 10^{-5}$  sec. This discrepancy can be explained by supposing that after light absorption the  $\text{Ac}_2$  mol. in an excited state *A* passes without radiation into a long-lived state *M*, lying near *A*, and that fluorescence occurs only after return to *A*. The state *M* may correspond with a tautomeric rearrangement of the mol.  $\text{COMe}_2$ , irradiated with 3130 Å., shows fluorescence identical with that of  $\text{Ac}_2$

irradiated with 4358 Å., but the fluorescence increases with time according to a growth curve  $I_t = I_0(1 - e^{-kt})$ . It is produced immediately and in high intensity by the addition of  $\text{Ac}_2$ . Its mean life in  $\text{COMe}_2$  is equal to that in  $\text{Ac}_2$  and is independent of the intensity of the exciting illumination. It is inferred that the same mol., probably  $\text{Ac}_2$ , is responsible for the fluorescence in the two cases, and possible mechanisms of the excitation of  $\text{Ac}_2$  in  $\text{COMe}_2$  are discussed. J. W. S.

**Raman spectrum of sugar.** A. L. S. Rao (*Indian J. Physics*, 1940, 14, 207—212).—An aq. solution of sucrose gave 16 Raman frequencies which have been assigned to constituent linkings and compared with frequencies obtained for glucose and cryst. sucrose. W. R. A.

**Dielectric constant of an electronic medium at medium radio-frequency.** S. R. Khastgir and C. Choudhury (*Indian J. Physics*, 1940, 14, 213—229).—Variation of effective dielectric const. ( $\epsilon$ ) of the electronic medium in the anode screen-grid space of a thermionic valve under varying conditions at medium radio frequencies ( $f$ ) has been studied. The no-beat technique of a double heterodyne method was employed.  $\epsilon$  was calc. according to the Lorentz formula for the dielectric const. of a frictionless electronic medium, allowance being made for the conductivity of the medium, and a multiplying factor ( $\mu$ ) was introduced to obtain the effect of time of stay ( $t$ ) of the electrons in the inter-electrode space. At fixed  $f$  and  $t$ ,  $\epsilon$  decreased approx. with increase of the thermionic current ( $i$ ). With  $i$  and  $t$  fixed,  $\epsilon$  decreased  $\propto f^2$ . When  $i$  and  $f$  were const. the change of capacity on filling the inter-electrode space with electrons increased with increasing  $t$ .  $\mu$  is, therefore, independent of  $f$ , and dependent only on  $t$ . The parabolic variation in  $\epsilon$  with the variation of the magnitude of the measuring field was not observed at the frequencies used; however, a steady variation in some cases was found and is explained. W. R. A.

**Charge distribution and dipole moment of the C—H bond.** C. A. Coulson (*Proc. Camb. Phil. Soc.*, 1940, 36, 509—510).—From  $\text{CH}_4$  wave functions, each H atom in  $\text{CH}_4$  has a net positive charge 0.101e, giving a rather high val. 0.53 D. for the dipole moment of C—H. L. J. J.

**Solvent action on optical rotatory power. III. Influence of liquid structure on the interaction of dipoles.** C. O. Beckmann and H. C. Marks. IV. Rotivity of diethyl dipropionyl-*d*-tartrate and *L*-menthyl acetate in aromatic and aliphatic solvents. H. C. Marks and C. O. Beckmann (*J. Chem. Physics*, 1940, 8, 827—830, 831—839; cf. A., 1937, I, 65; 1938, I, 232).—III. Theoretical. By introducing the London dispersion forces and the structural characteristics of a liquid system, an equation for the change of rotivity per g.-mol. of dipole solvent in unit vol. of a solution is obtained, of similar form to that deduced previously for a mixture of gases which are perfect except for dipole interaction.

IV. The vals. of  $[\alpha]_D^{25}$  for solutions of  $\text{Et}_2$  dipropionyl-*d*-tartrate in various binary mixtures of cyclohexane, cyclohexyl cyanide, 1-nitro-1-methylcyclohexane,  $\text{PhCN}$ ,  $\text{PhNO}_2$ , and  $\text{C}_6\text{H}_6$  have been measured. The results are discussed with reference to the theory, and agreement is found over wide ranges of concn. J. W. S.

**Energy levels of a rotating vibrator.** I. Sandeman (*Proc. Roy. Soc. Edin.*, 1940, 60, 210—223).—Mathematical. Dunham's theoretical work for the diat. mol. is amplified and simplified, and the calculation of mol. consts. from spectral data is shortened. O. D. S.

**Structure of the phosphorus chloronitrides.** G. N. Copley (*Chem. and Ind.*, 1940, 789—790).—The usually accepted structures of the P chloronitrides,  $(\text{PNCl}_2)_n$  ( $n = 3-7$ ), involving conjugated rings of alternate N and P atoms is criticised on account of the instability of eight- and higher-membered rings. New formulae, in which, however, the cyclic formula for the simplest member ( $n = 3$ ) is retained, are proposed. Structural formulae indicating the course of the reaction  $\text{P}_2\text{N}_2(\text{NH}_2)_6 + 3\text{NH}_3 \rightarrow (\text{PN}_2\text{H})_3 \rightarrow \text{P}_2\text{N}_5$  are given. A. J. M.

### III.—CRYSTAL STRUCTURE.

**Correction of lattice spacings for refraction.** A. J. C. Wilson (*Proc. Camb. Phil. Soc.*, 1940, 36, 485—489).—The true lattice spacing of a cubic crystal is  $>$  the extrapolated lattice spacing by a fraction  $1-n$  of itself. Refraction makes a relatively small contribution to line width. L. J. J.

**Structure of *m*-dinitrobenzene by Patterson Fourier summation.** K. Banerjee and M. Ganguly (*Indian J. Physics*, 1940, 14, 231—236).—From the analysis interat. vectors in the unit cell have been calc. and the at. arrangements have been determined. W. R. A.

**Crystal structure models for close-packed systems.** D. B. Langmuir and R. B. Nelson (*Rev. Sci. Instr.*, 1940, 11, 295—297).—The method uses transparent boxes with plane walls, the edges of which have the relative directions along which rows of atoms are close-packed in the given crystal structure. Spheres poured into the box automatically take up positions corresponding with the lattice for which the box was designed. The edges and surfaces which should bound models for the face-centred cubic, simple cubic, body-centred cubic, and hexagonal close-packed systems are given. A. J. M.

**Dependence of crystal structure on chemical properties.** I. I. Zaslavski (*J. Gen. Chem. Russ.*, 1940, 10, 369—379).—Three types of crystal structure are distinguished for diat. mols. of the type MX, viz., that of ZnS, of NiAs, and of NaCl. These types lie within definite areas of the at. structure-mol. vol. diagrams. This is shown to hold for 141 salts of the type MX. R. T.

**Secondary emission and electron diffraction on a glass surface.** H. Kamogawa (*Physical Rev.*, 1940, [ii], 58, 660; cf. A., 1938, I, 441).—Electron diffraction patterns were obtained by a method which maintained the glass surface electrically neutral. Polished optical glass gave haloes which suggest a structure of the surface layer different from that of the bulk glass. Surfaces of optical glass containing a high % of BaO or PbO showed, after prolonged exposure to damp H<sub>2</sub>S, diffraction rings indicating the formation of films  $\sim 1$  light  $\lambda$  thick of BaSO<sub>4</sub> or PbS—PbSO<sub>4</sub>. N. M. B.

**Interpretation of ferromagnetic colloid patterns on ferromagnetic crystal surfaces.** W. C. Elmore (*Physical Rev.*, 1940, [ii], 58, 640—642; cf. Heaps, A., 1940, I, 254).—It is shown that the bodily motion of particles rather than a magneto-optic effect (cf. McKeehan, *ibid.*, 350) is chiefly responsible for field-induced changes in ferromagnetic colloid patterns on ferromagnetic crystal surfaces. A simple relation between colloid concn. and magnetic field intensity near the crystal surface is deduced from Boltzmann's distribution law. The formation of elongated chains of particles in a colloid in a magnetic field is shown to be unlikely if the particles are sufficiently small. N. M. B.

**Stability of crystal lattices. III. Attempt to calculate the tensile strength of a cubic lattice by static considerations.** M. Born and R. Fürth (*Proc. Camb. Phil. Soc.*, 1940, 36, 454—465; cf. A., 1940, I, 288).—The energy density of a cubic lattice, homogeneously deformed by a force in the direction of one axis, is calc., and equilibrium and stability conditions for small additional deformations in an arbitrary direction are derived. Tensile strength so calc. is not in agreement with experimental data. L. J. J.

**Stability of crystal lattices. IV.** M. Born and R. D. Misra (*Proc. Camb. Phil. Soc.*, 1940, 36, 466—478; cf. preceding abstract).—A method is developed for deriving higher terms than the second in the expression for deformation energy for the case of a highly strained cryst. lattice. L. J. J.

**Elasticity of crystals.** S. Siegel and R. Cummerow (*J. Chem. Physics*, 1940, 8, 847).—A plot of the reduced temp. ( $\theta = T/T_m$ , where  $T_m$  = k. = m.p.) against the ratio of the val. of the modulus of elasticity at  $T^\circ$  k. to its val. at  $\theta = 0.5$  yields curves which are coincident for Pb, Al, and Na, but do not approach zero at the m.p. (cf. Born, A., 1939, I, 552). Data for NaCl do not fall on the same curve as those for the metals. J. W. S.

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

**Thermal and electrical conductivities of metals and alloys.** W. F. Chubb (*Phil. Mag.*, 1940, [vii], 30, 323—330).—A review of relations existing between thermal and electrical conductivities of metals and alloys is given, and it is concluded that the relative inaccuracy of thermal conductivity determinations accounts for the anomalies that have arisen in their interpretation. This, however, does not apply to the Wiedemann-Franz and the Wiedemann-Franz-Lorenz laws, deviations from which are not due to errors in thermal conductivity

determinations. These laws are not strictly applicable to alloy series. A. J. M.

**Theoretical magnetic susceptibilities of metallic lithium and sodium.** J. B. Sampson and F. Seitz (*Physical Rev.*, 1940, [ii], 58, 633—639).—Inclusion of Bardeen's effective masses and exchange and correlation terms in computations using present knowledge of the electronic structure of Li and Na appreciably affects the theoretical paramagnetism for free electrons, giving results differing from those from Pauli's equation with assumption that electrons are free and that exchange and correlation terms may be neglected. The calc. susceptibility for Na is close to the observed val., but for Li is about twice the highest experimental one. Sources of error are examined. The level density curves obtained from X-ray emission curves are discussed, and it is concluded that all details of these curves cannot be explained on the ordinarily used simple picture. N. M. B.

**Magnetic properties of metallic cerium.** C. Starr and A. R. Kaufmann (*Physical Rev.*, 1940, [ii], 58, 657).—Data for the magnetisation per g. of Ce as a function of field strength at various temp., and the magnetisation intercept, representing the saturation magnetisation of the ferromagnetic term, are plotted. The observed intercept vals. show anomalies possibly due to the presence of Fe impurity. Effects of heat-treatment, annealing, and ageing are examined. N. M. B.

**Magnetic evidence regarding the state of metallic ions in phosphate glasses.** S. S. Bhatnagar, B. D. Khosla, and R. Chand (*J. Indian Chem. Soc.*, 1940, 17, 515—520).—Magnetic susceptibility measurements have been made on glasses prepared from NaNH<sub>2</sub>HP<sub>2</sub>O<sub>4</sub> with addition of traces of Mn, Co, or Ni, with or without subsequent reduction by the addition of tartaric acid. The results indicate that in reduced colourless Mn glasses the metal is present as Mn<sup>II</sup>, whilst in the violet-pink glass it exists as a mixture of Mn<sup>II</sup> and Mn<sup>III</sup>. Co in the glass, whether reduced or not, is present as Co<sup>II</sup>. In yellow glass Ni is present as Ni<sup>III</sup>, but in the opaque reduced glass metallic Ni is present. J. W. S.

**Measurements of high-frequency permeability.** W. Jackson (*Phil. Mag.*, 1940, [vii], 30, 247—251).—The high-frequency permeability of mumetal, stalloy, mild steel, and 6% W steel, hardened and unhardened, has been determined. The effect of the magnetising force on the permeability is considered. A. J. M.

#### V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

**Thermodynamics of real gas mixtures. II. Specific heat of gas mixtures.** E. Justi (*Feuerungstechn.*, 1939, 27, 297—301; cf. A., 1939, I, 363).—On mixing gases deviations occur from Amagat's law of the additivity of vols., and from Dalton's law of the additivity of pressures, which can be expressed for medium pressures by simple formulae for all temp. and concns. The sp. heat of real gas mixtures is not additive, because of interaction between dissimilar mols. For the mixtures He-A and CH<sub>4</sub>-C<sub>2</sub>H<sub>6</sub> the sp. heats were deduced from  $p$ - $v$ - $T$  measurements, and for H<sub>2</sub>-N<sub>2</sub> from the Joule-Thomson effect. R. B. C.

**Temperature assignments of experimental thermal diffusion coefficients.** H. Brown (*Physical Rev.*, 1940, [ii], 58, 661—662; cf. A., 1940, I, 155; Jones, *ibid.*, 389).—Mathematical. N. M. B.

**Confirmation of the theory of thermal diffusion.** T. I. Taylor and G. Glockler (*J. Chem. Physics*, 1940, 8, 843—844).—Using a 40-ft. diffusion column, with wall spacing of 0.95 cm., the separation factor for CH<sub>4</sub> at various pressures is in fairly good agreement with theory (A., 1939, I, 395). Max. concn. of <sup>13</sup>CH<sub>4</sub> was attained at 28 mm. pressure. J. W. S.

**Viscosity in the system ammonia-ethyl alcohol.** A. Murta-zae and Z. Skljarova (*J. Gen. Chem. Russ.*, 1940, 10, 289—290).—The  $\eta$ -composition curve (temp. not specified) does not suggest compound formation. R. T.

**Precipitation in the alloys of copper and silver during ageing-hardening.** W. F. Cox and C. Sykes (*J. Inst. Metals*, 1940, 66, 381—387).—The pptn. of the second phase on ageing a quenched 7.7% Cu-Ag alloy at 240° and a quenched 5.9% Ag-Cu alloy at 380° has been followed by X-ray examination and by diamond pyramid hardness tests. In both alloys the lines of the pptd. phase are visible after 1 hr., and max.

hardness is attained in about 2 hr. The lattice parameters of the two phases are the same for both alloys within  $\pm 0.02\%$  at max. hardness and the min. size of the pptd. particles is  $\sim 100 \text{ \AA}$ .  
A. R. P.

**Hardening in the system gold-indium.** F. Weibke (*Z. Elektrochem.*, 1940, **46**, 346—348; cf. A., 1939, I, 69).—Alloys with 7% of In quenched from  $600^\circ$  and tempered for 2 hr. at  $300^\circ$  show an increase of Brinell hardness up to 56% compared with quenched but untempered alloys. Alloys with In 4% do not show this effect unless they are rolled before tempering, when an increase of 32% is obtained. F. L. U.

**Gold-cadmium alloys rich in gold.** E. A. Owen and E. A. O'D. Roberts (*J. Inst. Metals*, 1940, **66**, 389—400).—X-Ray investigation has revealed the existence of two new phases in the area previously believed to be pure  $\alpha$ . The  $\alpha_1$  phase has a face-centred tetragonal structure  $a$  4.1074,  $c/a$  1.0037 and the  $\alpha_2$  phase a hexagonal structure  $a$  2.9026,  $c/a$  1.6407. The  $\alpha_1$  region extends from Cd 24.5 to 26.0 at.-% at room temp. and closes at Cd 25 at.-% at  $425^\circ$ ; it is bounded by a very narrow (0.6 at.-% wide)  $\alpha_1 + \alpha_2$  region on the Cd side and by a much broader  $\alpha + \alpha_1$  region (Cd  $\sim 15$  at.-% at  $20^\circ$  to 23.4 at.-% at  $425^\circ$ ) on the Au side. Above  $425^\circ$  there is a narrow band of  $\alpha + \alpha_2$  extending in a curve from Cd 23.4—25.3 at.-% at  $425^\circ$  to 32.5—34 at.-% at  $625^\circ$ . The  $\alpha_2$  field closes on a peritectic horizontal at  $625^\circ$ , Cd 34 at.-%, and extends to Cd 35.7 at.-% at the eutectic temp. ( $612^\circ$ ).  
A. R. P.

**Equilibrium diagram of the system copper-nickel-silicon.** M. Okamoto (*Nippon Kinzoku Gakkai-Si*, 1939, **3**, 365—402).—The diagram is very complex since no pseudo-binary system is formed between any of the constituents of the Cu-Si and Ni-Si systems, nor does any extensive series of solid solutions exist between them. A ternary compound is formed in the range Si 12—15 and Ni 11—12% by a peritectic reaction at  $859^\circ$  and the ternary  $\gamma$  phase is formed by a similar reaction at a max. of  $954^\circ$ . The system contains 13 primary crystal phases, 26 univariant curves, and 13 non-variant points.  
A. R. P.

**Ternary solid solution copper-nickel-silicon.** M. Okamoto (*Nippon Kinzoku Gakkai-Si*, 1939, **3**, 411—420).—The  $\alpha$ -range at the Cu end of the system has been delineated; from the solution saturated at high temp. the  $\gamma$ ,  $\gamma'$ ,  $\beta'$ , or  $\kappa$  phases are pptd. on cooling according to the composition, and all may induce pptn. hardening when the quenched alloys are reheated at  $425$ — $550^\circ$ . Max. hardness is not shown by alloys on the Cu-Ni-Si line.  
A. R. P.

**Solubility of lanthanum in aluminium, magnesium, and homogeneous magnesium-aluminium alloys.** F. Weibke and W. Schmidt (*Z. Elektrochem.*, 1940, **46**, 357—364).—La is insol. in Al. It begins to dissolve in Mg at  $450^\circ$  and the solubility reaches 3% at  $609^\circ$ , the eutectic temp. Addition of Al to the Mg up to saturation does not greatly affect the solubility of La, but considerably reduces the initial m.p. Of the neighbouring elements Ba is nearly insol. in solid Mg, whilst Ce dissolves to the extent of 2.2% at the eutectic point ( $585^\circ$ ), the solubility decreasing rapidly with falling temp. to 0.5% at  $440^\circ$ . Addition of La to Mg causes an increase in the Brinell hardness on tempering the quenched metal for a short time at  $300^\circ$ . The electrical resistance of Mg and of Mg-Al alloys is little changed by La, and at the higher concns. (2—4%) is  $<$  that of pure Mg and of the La-free alloy respectively. On the other hand addition of Al considerably increases the resistance of Mg. F. L. U.

**Solubility of methane in cyclohexane.** E. P. Schoch, A. E. Hoffmann, and F. D. Mayfield (*Ind. Eng. Chem.*, 1940, **32**, 1351—1353).—Using the method described previously (A., 1940, I, 319), sp. vol. and bubble-point pressure data have been obtained for various mixtures of  $\text{CH}_4$  and cyclohexane (11.75—73.85%  $\text{CH}_4$ ) at  $100.27^\circ$ ,  $160^\circ$ , and  $220^\circ \text{ F}$ .  
J. W. S.

**Equilibrium solutions of lactose-salt mixtures.** O. G. Jensen, Z. M. Hanford, and G. C. Supplee (*J. Dairy Sci.*, 1940, **23**, 745—753).—Solubilities of lactose in 24 salt solutions are given. Certain salts increase the solubility by forming complexes.  
J. G. D.

**Cane molasses. II. Solubility of sugars in aqueous salt solutions.** K. A. N. Rao and G. N. Gupta (*J. Indian Chem. Soc.*, *Ind. Edit.*, 1940, **3**, 49—51).—The quantities of sucrose, glucose, and fructose dissolved by 5% aq. solutions of

numerous salts, and of sucrose and glucose dissolved by 10% salt solutions, are recorded.  
I. A. P.

**Reduction by activated charcoal of sliver ions from aqueous solutions in the presence of alcohols.** M. S. Belenki and L. I. Kovaleva (*Kolloid. Shurn.*, 1939, **5**, 219—224).—Charcoal was washed out with dil.  $\text{HNO}_3$  and shaken with aq.  $\text{AgNO}_3$  the concn. of which was determined before and after contact with C. The amount of Ag adsorbed and reduced is lowered by alcohols; higher alcohols (up to  $\text{C}_6\text{H}_{13}\text{OH}$ ) are more effective than EtOH and  $\text{Pr}^n\text{OH}$ . The alcohols are adsorbed by C as shown by an increase in the surface tension.  
J. J. B.

**Theory of non-dissolving volume (negative adsorption).** B. A. Derjaguin (*Kolloid. Shurn.*, 1939, **5**, 257—261).—Negative adsorption takes place when solvent molcs. are more strongly attracted by the adsorbent than the molcs. of solute. It should increase when the vol. of the mol. of solute increases. A possible change of it with dilution is calc.  
J. J. B.

**Colloid chemistry of high temperatures. III. Adsorptive capacity of thermally desolvated clays.** S. I. Djatschkovski and A. J. Gurvitsch (*Kolloid. Shurn.*, 1939, **5**, 271—276).—A clay was used either without heat-treatment (I), or after boiling with  $\text{H}_2\text{O}$  for 4 hr. (II), or after heating with  $\text{H}_2\text{O}$  at  $150^\circ$  (III). The adsorption of fuchsin and methylene-blue from aq. solutions increases from (II) to (I) to (III). Adsorption of  $\text{NH}_3$  gas by (I) is  $>$  by (III). The change produced by heating to  $150^\circ$  is termed "de-solvation."  
J. J. B.

**Adsorption accompanied by chemical reaction.** A. V. Snamenski (*Kolloid. Shurn.*, 1938, **4**, 631—639).—The amount of NaOH taken up by cotton from a solution of concn.  $c$  is  $\propto c^2$ , a result which is accounted for if it is supposed that Na-cellulose is formed and at the same time NaOH is adsorbed according to the Freundlich isotherm. Mercerised cotton sorbs more NaOH than unmercerised cotton. For the sorption of  $\text{H}_2\text{C}_2\text{O}_4$  by  $\text{Fe}(\text{OH})_3$   $q_1 q_2 \propto c^2$ , where  $q_1$  is the amount adsorbed by 1 g. of adsorbent and  $q_2$  the amount of  $\text{H}_2\text{C}_2\text{O}_4$  reacting chemically with the  $\text{Fe}(\text{OH})_3$ .  
R. C.

**Importance of polarity of medium for adsorption of substances by composite briquetted adsorbents.** N. F. Jermolenko and L. J. Rabinovitsch (*Kolloid. Shurn.*, 1939, **5**, 5—11).—Filter-paper was soaked in water-glass, treated with HCl, and briquetted under the pressure  $p$ . The briquettes were carbonised at  $700^\circ$  and used as adsorbents. The adsorptive capacity decreases when  $p$  increases from 500 to 2300 kg. per sq. cm. The adsorption of picric acid from mixed solvents increases when the % of  $\text{C}_6\text{H}_6$  in a mixture with  $\text{CCl}_4$ , or of EtOH in aq. EtOH, decreases. There is a weak min. at 25 vol.-% of  $\text{C}_6\text{H}_6$  in its mixtures with EtOH and  $\text{CHCl}_3$ . The adsorption by charcoal shows a min. at 25 vol.-% of  $\text{C}_6\text{H}_6$ , and that by  $\text{SiO}_2$  a max. at 75% of  $\text{C}_6\text{H}_6$  in  $\text{C}_6\text{H}_6$ -EtOH mixtures.  
J. J. B.

**Importance of constitutional properties of organic acids for their adsorption from mixed solvents.** N. Jermolenko and D. Ginsburg (*Kolloid. Shurn.*, 1939, **5**, 263—270).—The adsorption on wood charcoal of  $\text{CH}_2\text{Cl}\cdot\text{CO}_2\text{H}$  (I),  $\text{CHCl}_2\cdot\text{CO}_2\text{H}$  (II), and  $\text{CCl}_3\cdot\text{CO}_2\text{H}$  (III) is from  $\text{CCl}_4$   $>$  from  $\text{H}_2\text{O}$   $>$   $\text{C}_6\text{H}_6 >$  EtOH; in  $\text{C}_6\text{H}_6$  and EtOH the adsorption of (III)  $>$  (II)  $>$  (I), and in  $\text{H}_2\text{O}$  and  $\text{CCl}_4$  that of (I)  $>$  (II)  $>$  (III). The adsorption from EtOH- $\text{C}_6\text{H}_6$  mixtures has a min. approx. corresponding with the max. of the mol. polarisation; no singular points are present in the curves for other solvent mixtures. For AcOH the order is  $\text{H}_2\text{O} >$   $\text{CCl}_4 >$   $\text{C}_6\text{H}_6 >$  EtOH, for  $o\text{-OH}\cdot\text{C}_6\text{H}_4\cdot\text{CO}_2\text{H}$   $\text{H}_2\text{O} >$   $\text{CCl}_4 >$   $\text{C}_6\text{H}_6 >$  EtOH  $>$   $\text{COMe}_2$ , and for  $m\text{-NH}_2\cdot\text{C}_6\text{H}_4\cdot\text{CO}_2\text{H}$   $\text{H}_2\text{O} >$  EtOH. The adsorption of  $o\text{-OH}\cdot\text{C}_6\text{H}_3\cdot\text{CO}_2\text{H}$  shows a min. in  $\text{COMe}_2\text{-C}_6\text{H}_6$  mixtures but none in other mixtures.  
J. J. B.

**Calculation of surface tension from intermolecular forces.** J. E. Lennard-Jones and J. Corner (*Trans. Faraday Soc.*, 1940, **36**, 1156—1162).—The general relations between  $\gamma$  and intermol. forces are discussed, using  $\phi_0\{(\gamma_0/r)^{12} - 2(\gamma_0/r)^6\}$ , where  $\phi_0$  and  $\gamma_0$  are const., for the intermol. potential. Adopting the theory of liquid structure previously developed (cf. A., 1939, I, 385 and previous abstracts), it is shown that certain empirical laws (e.g., Eötvös's) can be deduced theoretically. The properties of the parachor are examined and  $[P]$  is shown to be related to the intermol. field const. by the expression  $[P]\phi_0^{-1}\gamma_0^{-2} = \text{const.}$   
F. L. U.

**Anomalous osmosis.** K. Sollner and I. Abrams (*J. Gen. Physiol.*, 1940, **24**, 1—5).—Phenomena of anomalous osmosis,

such as those described by Loeb, cannot be obtained with membranes made from relatively pure collodion (I), but positive effects are observed if the (I) contains acidic impurities. Large anomalous effects are obtained when the inactive (I) has been treated with NaOBr. D. M. N.

**Scattering of light by coarse aerosols.** I. L. V. Smirnov. II. L. V. Smirnov and N. M. Bashenov (*Kolloid. Shurn.*, 1938, 4, 717—723, 745—748).—I. The variation of light scattering,  $I$ , with  $\lambda$  for coarse mists of Solar oil and glycerol is represented by  $I \propto \lambda^x$ , where  $x > 0$ . This observation accords with calculations based on Mie's theory.

II. The general conditions for the validity of the above equation have been worked out; for a Solar oil mist the particle radius must lie between 0.4 and 0.7  $\mu$ , which agrees with experiments. R. C.

**Preparation of paraffin emulsions by magnetostrictional vibrations.** S. S. Tumanski (*Kolloid. Shurn.*, 1939, 5, 105—110).—A Ni-tube vibrator was used at a frequency of 4000—20,000 cycles. Pure paraffin oil gave 6% emulsions in H<sub>2</sub>O which broke within a few days. Stable emulsions of 10 g. of oil in 100 g. of H<sub>2</sub>O were prepared in presence of 8 g. of  $\alpha$ -diethylamino- $\beta$ -oleamidoethane ("sapamine MS") or of 3 g. of gelatin. The rate of prep. decreases when the intensity of the supersonic field increases; the frequency has no effect. J. J. B.

**Dispersion of metals in liquids by supersonic field.** L. N. Solovieva (*Kolloid. Shurn.*, 1939, 5, 289—297).—A quartz oscillator vibrating  $4 \times 10^8$  times per sec. was used. The loss of wt. of plates subjected to supersonic field in H<sub>2</sub>O increased in the order Cu < Al < Ni < Sn < Pt < Au < Cd < Zn < Mg < Bi < Pb; Zn, Mg, and Pb formed hydroxides. In paraffin oil only Bi, Pb, and Cd could be dispersed. Addition of 0.2% of Na oleate lowered the dispersion in H<sub>2</sub>O; addition of oleic acid (up to 100%) or stearic acid (up to 5%) to paraffin oil strongly increased the dispersion of Pb. The dispersion of Pb in H<sub>2</sub>O is strongly reduced by sugar and Bu<sup>x</sup> xanthate and is not affected by saponin; 0.1% of Na oleate reduces it more than 1% of Na oleate. A tentative explanation of these observations is advanced. J. J. B.

**Formation and crystallisation of colloidal calcium sulphate.** P. P. Budnikov and D. P. Bobrovnik (*Kolloid. Shurn.*, 1938, 4, 483—495).—CaSO<sub>4</sub> sol has been prepared by interaction of CaCl<sub>2</sub> and H<sub>2</sub>SO<sub>4</sub> in MeOH solution. The crystallisation of CaSO<sub>4</sub>·2H<sub>2</sub>O on addition of H<sub>2</sub>O to the sol was followed by  $\eta$  measurements, parallel measurements being made with CaSO<sub>4</sub>·2H<sub>2</sub>O suspensions. The nature of the crystals produced was examined microscopically. Inorg. acids promote crystal growth. An aq. extract of peat accelerates the sol-gel change and the formation of crystal nuclei, but retards the growth of these nuclei, so that the final product consists largely of crystals of sub-microscopic size. R. C.

**Ageing of sols and gels.** V. Influence of electrolytes on the formation of sols of mercury acetamide. E. M. Preis and M. A. Nikolaeva (*Kolloid. Shurn.*, 1939, 5, 169—174; cf. A., 1937, 361).—Sols of (NHAc)<sub>2</sub>Hg (I) gelate in presence of nitrates, oxalates, or acetates, and the  $p_H$  of the sol (measured with a glass electrode) does not change in the course of gelation. KCl, KBr, KI, KCNS, and Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> when mixed with (I) liberate alkali, the amount of which is equiv. to the (I) present. If insufficient amounts of salts are used the amount of alkali liberated increases in the series KCl < KSCN < KBr < Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> < KI. The lyotropic series also applies to reactions between truly dissolved substances. J. J. B.

**Effect of acetic acid and acetate buffers on structure of aluminium hydroxide sols.** Z. I. Aristova (*Kolloid. Shurn.*, 1938, 4, 671—677).—AcOH peptises,  $\eta$  falling steadily. With a buffer of  $p_H$  3.2  $\eta$  increases with time, and the coagulating action of the OAc<sup>-</sup> ion predominates over the peptising action of AcOH. With rise in  $p_H$  the coagulating action increases, but passes through a max. with time, suggesting thixotropy. The PO<sub>4</sub><sup>'''</sup> ion has a powerful coagulating action even at low concn. R. C.

**Chemical factors influencing development of structure in and stability of aluminium hydroxide sols.** I. Effect of heating. II. Effect of neutral salts and caustic alkalis on development of structure. E. I. Kviat (*Kolloid. Shurn.*, 1938, 4, 551—560, 621—629).—I. When these sols are heated  $\eta$  and the stability fall, and the structural branch on the  $p_t$ - $p$

curve, where  $t$  is the time of flow through an Ostwald viscometer under pressure  $p$ , becomes less marked. These seem to be consequences of olation and oxolation (cf. Stiasny and Grimm, B., 1928, 24). The  $p_H$  also falls, owing to hydrolysis both on the surface of the micelles and within the solution. As sols which have not been boiled age at room temp. the  $p_H$  usually falls; with sols which have been boiled the reverse is true, due to deolation, but the  $p_H$ -time curve differs considerably from that for Fe(OH)<sub>3</sub> sols, for which hydrolytic effects apparently outweigh olation.

II. The structures developed in sols may be "extended" or "compact." The former type are loosely constructed and increase  $\eta$  considerably and their development leads to gelation, whilst compact structures do not give rise to a structural branch on the  $p_t$ - $p$  curve. In certain circumstances one type of structure may change into the other. Heating, ageing, or addition of electrolytes leads to the formation of both types of structure. Addition of neutral salts or caustic alkalis to Al(OH)<sub>3</sub> sols promotes development of structure to an extent depending on the age of the sol, its previous thermal history, and the temp. at which the mixture is heated. The rate of structure development increases with age, and is influenced by the wall of the containing vessel. The behaviour of undialysed Al(OH)<sub>3</sub> sols containing alkali resembles that of Fe(OH)<sub>3</sub> sols. R. C.

**Colloid-chemical investigation of the Chasov Yar clay No. 5.** E. A. Shurigina and S. E. Charin (*Kolloid. Shurn.*, 1939, 5, 175—183).—When clay is saturated with various cations and dialysed the % of particles below 1  $\mu$ . increases in the series Ca-clay < H- < native clay < K- < NH<sub>4</sub>- < Na-clay. The opacity of a 0.1% suspension is high for Na-, NH<sub>4</sub>-, and K-clays, and low for native and H-clay. The rate of electro-osmosis of H<sub>2</sub>O through a clay membrane increases in the order Ca- < H- < native < NH<sub>4</sub>- < Na-clay. The adsorption of H<sub>2</sub>O (calc. from the negative adsorption of KCl) is high for Na- and K-clays and low for H-clay. The electrokinetic potential seems to be the factor determining the peptisation and stability of clay suspensions. J. J. B.

**Plastic viscous properties of mica suspensions.** I. S. Erochin (*Kolloid. Shurn.*, 1939, 5, 69—78).—Mica suspensions in liquid paraffin and a rotating-cylinder viscometer were used. 20% and 25% suspensions are not thixotropic and have low yield point. In 30—40% suspensions  $\eta$  is reduced by rotating the cylinder and increased again by stirring; the yield point is high. It is calc. that in 30% suspension the mica particles (0.1  $\times$  0.01  $\times$  0.001 mm.) are surrounded by "immobilised" oil layers 3  $\mu$ . thick; this is the min. thickness at which the structural part of  $\eta$  becomes important. J. J. B.

**Viscosity of thorium arsenate gels during setting.** M. Prasad and B. G. Shejwalkar (*J. Indian Chem. Soc.*, 1940, 17, 508—514).—The viscosity ( $\eta$ ) of Th arsenate gel-forming mixtures [Th(NO<sub>3</sub>)<sub>4</sub> + HAsO<sub>4</sub>] increases with time, slowly at first, then rapidly, and finally in many cases reaches limiting vals. The  $\eta$  after a certain time is decreased by increase in [Th(NO<sub>3</sub>)<sub>4</sub>] in the mixture, addition of non-electrolytes (alcohols or glycerols), or rise of temp., but is increased by increase in the [HAsO<sub>4</sub>] or by addition of electrolytes (KCl or BaCl<sub>2</sub>). The results confirm that the sol  $\rightarrow$  gel transformation is a continuous process. J. W. S.

**Four-component systems.** M. Cholodova (*Kolloid. Shurn.*, 1938, 4, 507—509).—The appearance of Fe(OH)<sub>3</sub> sols containing EtOH and succinic, malic, tartaric, or citric acid is described. R. C.

**Structural properties of ferric hydroxide sols.** E. I. Kviat (*Kolloid. Shurn.*, 1939, 5, 225—233).—The viscosity of a well-dialysed Fe(OH)<sub>3</sub> sol with  $p_H$  3.7 was low and little affected by boiling for 1 hr. That of a Fe(OH)<sub>3</sub> sol containing much FeCl<sub>3</sub> and having  $p_H$  2.9 was high; it increased tenfold on boiling and then slowly decreased; it was also anomalous. Whilst HCl had almost no effect on dialysed Fe(OH)<sub>3</sub> it reduced the  $\eta$  of the other sol. The  $\eta$  of the undialysed sol was at first lowered by alanine, but after 4 days was increased above that of the original sol. In dialysed sols heating increases the "olation" (second stage of hydrolysis). Alanine, which forms complexes with Fe, destroys the "ol" compounds. J. J. B.

**Mol. wts. of rubber and related materials.** I. Experimental methods. II. Osmotic pressure and viscosity of solu-

tions of raw rubber. G. Gee (*Trans. Faraday Soc.*, 1940, **36**, 1163—1171, 1171—1178).—I. The construction and operation of a new osmometer, and a method of determining v.p. lowering from the rate of isothermal distillation of solvent into a solution, are described. The interpretation of the results is discussed. Staudinger's  $\eta$ -mol. wt. relationship is examined and criticised.

II. Osmotic pressures of various kinds of raw rubber dissolved in  $C_6H_{11}OAc$ ,  $C_6H_6-MeOH$ , and  $C_6H_6-EtOH$  have been measured and used to calculate the mol. wt. A poor solvent or a mixture of solvent with precipitant gives solutions which approach ideal osmotic behaviour. Mol. wts. are also calc. from  $\eta$  measurements by Staudinger's law, which is valid for rubber solutions over the mol. wt. range 350,000—60,000. The osmotic and  $\eta$  methods agree for rubber fractions, whilst for unfractionated material the  $\eta$  method gives higher average vals. The mol. wt. of "sol" rubber is  $>$  that of "gel"; hence the sol-gel separation does not arise from difference of mol. wt. F. L. U.

Method of determination of the rate of swelling and dissolution of highly polymerised substances. T. I. Jurshenko (*Kolloid. Shurn.*, 1939, **5**, 147—152).—The vol. displaced by a swelling specimen is determined from time to time. For Na divinyl rubber in  $C_6H_6$  it first increases and then, because of incipient dissolution, decreases. The dissolution is completed the more rapidly the higher is the plasticity no. of the rubber. J. J. B.

Structure of water envelopes of hydrophilic colloids. Z. Tshesheva and M. Kolesova (*Kolloid. Shurn.*, 1938, **4**, 497—505).—The  $\zeta$ -potential and hydrophilic nature, measured by their power of adsorbing  $H_2O$  from glucose solutions, of various kinds of starch containing Na,  $Al_2O_3$ , and Pb tartrate have been determined. The results are interpreted in relation to the hydration of the ions and chemisorption by the starch surface. R. C.

Behaviour of cellulose in alkaline solutions.—See B., 1940, 848.

Changes in viscosity of cellulose nitrate sols. IV. Gelation of sols. A. V. Pamfilov, A. G. Schicher, and M. G. Schicher. V. Scheme of gelation. A. V. Pamfilov and M. G. Schicher (*Kolloid. Shurn.*, 1938, **4**, 569—585, 587—591).—IV. The gelation of sols of cellulose nitrate (I) in presence of Cu (A., 1936, 795) is accelerated by the presence of NO and  $N_2O_3$  and is the more rapid the less stable is the (I).  $Cu_2O$  increases  $\eta$ , but  $Cu^{II}$  salts have little effect.  $PbO$ ,  $Pb_3O_4$ , and, in certain circumstances  $Pb(OAc)_2$  have a marked gelling action. Sols prepared with stabilised (I) and solvents free from acid impurities gelate very slowly or not at all in presence of Cu or  $PbO$ . The presence of  $NHPh_2$  delays gelation considerably. Cu does not affect  $\eta$  of acetyl-, benzyl-, and ethyl-cellulose sols.

V. The above gelation is probably due to hidden coagulation rather than to compound formation. R. C.

Viscosity of cellulose triacetate solutions.—See B., 1940, 848.

Dielectric properties of cellulose derivatives in organic liquids.—See B., 1940, 849.

Tearing strength of agar gel. P. S. Shelezkov (*Kolloid. Shurn.*, 1938, **4**, 523—531).—The tearing strength,  $P_n$ , of a gel of concn.  $n$  is given by  $P_n/P_{n-d} = K$ , where  $P_{n-d}$  is the strength of a gel of concn.  $(n-d)$  and  $K$  is a const. for a given val. of  $n$ . If a gel prepared from an acid sol is heated at a given temp.,  $\theta$ , the strength after time  $t$  is given by  $P/P_{t+d} = k$ , where  $P_{t+d}$  is the strength after heating for a time  $(t+d)$  and  $k$  is a const. depending on  $d$ , and rising with  $\theta$  and the acidity. The results indicate that 75° is the optimum temp. for the pasteurisation of fruit jellies made with agar. R. C.

Swelling of pectins. T. K. Gaponenkov (*Kolloid. Shurn.*, 1938, **4**, 641—645).—The swelling of various pectic substances from sugar-beet and the heats of swelling in  $EtOH-H_2O$  mixtures have been measured.  $EtOH$  hinders the osmotic abstraction of  $H_2O$  from these mixtures, but hydration proceeds even at high  $[EtOH]$ . The heat of dissolution of araban in  $H_2O$  is almost wholly accounted for by the union of a  $H_2O$  mol. with each OH group of the solute. R. C.

Peptising effect of heat-treated gelatin. I. I. Sokolov (*Kolloid. Shurn.*, 1939, **5**, 111—124).—The coeff. of diffusion  $D$  of KCl in 3% gelatin (I) gel at 18° was  $2.2 \times 10^{-6}$ , and in 3%

gel of 99% of (I) + 1% of thermolysed gelatin (II)  $3.1 \times 10^{-6}$  sq. cm. per sec., showing that thermolysis products loosen the gel structure. The thermolysis was carried out at 100° for 60 hr.  $D$  of (I) in  $H_2O$  was 0.09 and that of (II) 0.27 sq. cm. per day, whilst  $D$  of 0.3% (I) into 0.25% (II) was 0.10 sq. cm. per day. It is concluded that sol. fractions of (I) peptise its insol. fractions. J. J. B.

Influence of ultra-frequent electric field on some physico-chemical properties of colloids. N. P. Sinitzin (*Kolloid. Shurn.*, 1939, **5**, 305—313).—Gelatin kept in the alternating field ( $\nu = 50,000$ ) of a condenser suffers no observable change in isoelectric point, swelling, m.p., i.p.,  $p_H$ , optical activity,  $n$ , or X-ray pattern. The field intensity was 50—200 v. per cm. J. J. B.

Micellar changes in ageing gelatin sols and gels. I. Bulankin (*Kolloid. Shurn.*, 1938, **4**, 657—670).—With increasing age of gelatin (I) gels kept at 20°, the power of mutarotation passes through a max., which depends on the concn.,  $c$ , and falls to a const. val., also depending on  $c$ . With (I) aged at 35° the power of mutarotation falls from the outset. The above max. corresponds with a min. surface tension, suggesting that the initial rise in the power of mutarotation is due to diminishing electrostatic solvation of the micelles. The next stage of ageing is characterised by a gradual loss in structural properties, as revealed by the declining power of mutarotation, and at the same time the  $EtOH$  no. increases and there is depolymerisation of the (I). From the constancy of the true sp. rotation at 35° and the relatively slight variation in  $NH_2-N$  it is inferred that ageing does not involve any profound chemical changes in the mol., but depends rather on dissociation of the micelles. R. C.

Structure and physicochemical properties of disaggregated gelatin. I. I. Sokolov (*Kolloid. Shurn.*, 1938, **4**, 533—549).—Heated gelatin sols lose their power of forming gels a little before  $\eta$  has fallen to a const. val. The brightness of the Tyndall cone is weakened by heating. The sp. rotation of disaggregated gelatin (I) varies little with temp., and at higher temp. is  $>$  that of normal gelatin (II). (I) has its isoelectric point at  $p_H$  4.4. From the absorption spectra of (I) and (II) in the visible and ultra-violet it appears that disaggregation entails a change in mol. structure. The polarograms show that (I) and (II) behave identically on electrolysis. If (II) is subjected to ultrasonic radiation from a magnetostrictive vibrator  $\eta$  falls and the ability to form a gel disappears. These observations agree with the theory that in the disaggregation of gelatin the polypeptide chains remain intact, but form some kind of cyclic structure. R. C.

Effect of ultra-violet radiation on gelatin films. S. A. Reitlinger (*Kolloid. Shurn.*, 1938, **4**, 679—687).—The swelling power and solubility fall, the  $\eta$  of the solution rises, and the heat of swelling and X-ray diagram are not affected. With films of thermolysed gelatin the time of irradiation required to produce the insol. form (I) increases with the duration of thermolysis. It is suggested that the transformation of gelatin into (I) consists in the formation of three-dimensional aggregates of the polypeptide chains by reaction of  $NH_2$  and  $CO_2H$  groups of the side-chains. The formation of such cross-linkings would oppose swelling. R. C.

Effect of Congo-red on coagulation of animal albumins by copper salts. I. B. S. Putschkovski (*Kolloid. Shurn.*, 1938, **4**, 561—567).—Congo-red (I) sensitises ovalbumin to pptn. by  $CuSO_4$ , and the effect in acid solution is  $>$  in absence of acid, apparently owing to the liberation of Congo-blue (II) by the acid. There is evidence that albumin reacts with (I) and (II). R. C.

Periodic structures. I. Periodic structures formed by evaporating solutions of nitrates. P. F. Michalev (*Kolloid. Shurn.*, 1938, **4**, 725—727).—Structures obtained by evaporating solutions of nitrates and ferrocyanides are described. R. C.

Laminar coagulation of colloidal ferric hydroxide. N. Jermolenko and G. N. Plenina (*Kolloid. Shurn.*, 1939, **5**, 193—199).—A slightly alkaline solution of lupin proteins was mixed with  $Fe(OH)_3$  sol and made to foam. The amount of Fe found in the foam increases linearly with  $[Fe(OH)_3]$  and is almost independent of the vol. of air used to produce the foam. It is suggested that protein and  $Fe(OH)_3$  form in the foam lamellæ a two-dimensional thixotropic gel. J. J. B.

## VI.—KINETIC THEORY. THERMODYNAMICS.

**Complex ion in solutions containing manganese and ammonium salts.** R. I. Agladze (*J. Gen. Chem. Russ.*, 1940, 10, 340—346).—The  $p_H$  of aq.  $MnCl_2$  is lowered by addition of aq.  $NH_4Cl$ ; this is ascribed to the reaction  $MnCl_2 + nNH_4Cl \rightleftharpoons [Mn(NH_3)_n]Cl_2 + nHCl$ . The existence of the complex ion  $Mn(NH_3)_n^{2+}$  is supported by the exceptionally high buffering capacity of the systems  $MnCl_2-NH_4Cl-H_2O$  or  $MnSO_4-(NH_4)_2SO_4-H_2O$ , by the non-pptn. of  $Mn(OH)_2$  in presence of  $NH_4$  salts, and by the flatness of the polarisation curves obtained in electrolysis of Mn salts in presence of  $NH_4$  salts. R. T.

**Metalloporphyrins.**—See A., 1940, II, 383.

**Thermodynamic study of bivalent metal halides in aqueous solution. V. Activity coefficients of cadmium chloride and bromide at 25°.** R. A. Robinson. **VI. Activity coefficients of manganese, cobalt, nickel, and copper chloride in aqueous solution at 25°.** R. A. Robinson and R. H. Stokes (*Trans. Faraday Soc.*, 1940, 36, 1135—1136, 1137—1138; cf. A., 1940, I, 359).—V. Data are recorded for the concn. range 0.1—6.0M. VI. Data are recorded for the concn. range 0.1—2.8M. F. L. U.

**Activity of metals in binary systems showing marked departure from ideal behaviour.** K. Hauße (*Z. Elektrochem.*, 1940, 46, 348—356).—Activities and activity coeffs. of the component metals have been determined by measuring the e.m.f. of cells of the type  $M + Na | glass | Na$ . Liquid Hg—Na and Cd—Na alloys were used in the temp. range 300—395°. The vals. of  $f_{Na}$  and  $f_{Hg}$  obtained are supplemented by vals. deduced from published v.p. data. In the Hg—Na system the vals. of  $RT \log_e f$  are nearly independent of temp. in the range 300—375°, and are therefore approx. equal to the partial mol. heats of mixing of the respective metals. The results in the system Cd—Na are in harmony with the existence of a liquid-miscibility gap as found by Mathewson (A., 1906, ii, 666) in the range Na 60—70 at.-%. In the system Hg—Sn vals. of  $RT \log_e f$  are calc. from v.p. and thermal data; the curves obtained by plotting these vals. against the mol. fraction are similar to those found for Hg—Na. F. L. U.

**Gas-liquid equilibrium constants. Methane-decane system.**—See B., 1940, 828.

**Equilibrium curves and boiling and condensation lines of ethyl alcohol-water mixtures under reduced pressures.** E. Kirschbaum and F. Gestner (*Z. Ver. deut. Ing. Beih. Verfahrenstechn.*, 1939, 10—15).—Data obtained with a new type of apparatus are presented. Equilibrium curves for abs. pressures of 50, 100, 250, 500, and 740 mm. Hg are deduced from the boiling and condensation lines. R. B. C.

**Reduction equilibrium of ferrous oxide in liquid iron by hydrogen.** I. Tajiri and Z. Shibata (*Tetsu-to-Hagane*, 1939, 25, 194—197).—The equilibrium const. of the reaction  $FeO$  (dissolved in Fe) +  $H_2 \rightleftharpoons Fe + H_2O$  was determined by passing  $H_2-H_2O$  mixtures over the metal at 1545—1700° and determining the residual  $FeO$ ;  $\log K = 6612/T - 3.55$ . For reduction of the  $FeO$  by  $CO$  within the same temp. range  $\log K = 7978/T - 4.88$ . A. R. P.

**Ternary system potassium nitrate-ammonium nitrate-water at 25°.** R. K. Bahl and S. Singh (*J. Indian Chem. Soc.*, 1940, 17, 441—442).—No double salts or salt hydrates occur in this system at 25°. J. W. S.

**Equilibrium relations of system  $NaCl-NH_4HCO_3-NaHCO_3-NH_4Cl-H_2O$  under high pressures of carbon dioxide.**—See B., 1940, 856.

**Heat of hydration of the proton.** E. C. Baughan (*J.C.S.*, 1940, 1403).—A recalculation of the heat of hydration of the proton using the latest data for the heats of hydration of foreign ions gives an average val.  $282.5 \pm 3$  kg.-cal. C. R. H.

## VII.—ELECTROCHEMISTRY.

**Electric conductivity of thin films of copper sulphide.** V. A. Kosheurov (*Kolloid. Shurn.*, 1939, 5, 45—61).—Films were prepared by passing 2%  $H_2S$  over solutions of  $CuSO_4$  or  $Cu(NO_3)_2$ . They reached in 10—15 sec. the final thickness of 160—210 Å. Their sp. resistance  $\rho$  was  $1.5-1.7 \times 10^{-2}$  ohm cm. It increases many times in a vac. and also in air on heating. Slow cooling after slow (several hr.) heating to 100° also

raises  $\rho$ ; a real temp. coeff. of  $\rho$  does not exist. Heating to 200° in S vapour does not affect  $\rho$  but changes the colour of the film from brown to green. Presumably the films are  $Cu_2S$ ; their relatively high conductivity is due to the presence of S which evaporates at high temp. or in a vac. J. J. B.

**Effect of sucrose on transport number, conductivity, viscosity, and  $[H^+]$  of solutions of hydrochloric acid.** I. I. Shukov and G. F. Dneprov (*J. Gen. Chem. Russ.*, 1940, 10, 291—294).—At 25—35° the val. of the transport no. of  $Cl^-$  is unaffected by up to 20% of sucrose in 0.1N-HCl, but falls steadily as the concn. exceeds 20%. Conductivity and  $p_H$  fall, and  $d$  rises, with increasing sucrose concn., whilst  $\eta$  rises very gradually up to 50% sucrose, and steeply as this concn. is exceeded. R' T.

**Transport numbers of zinc chloride from e.m.f. measurements.** A. C. Harris and H. N. Parton (*Trans. Faraday Soc.*, 1940, 36, 1139—1141).—The e.m.f. of the cells  $Zn | Hg | ZnCl_2(m_1) | AgCl(s) | Ag$  and  $Ag | AgCl(s) | ZnCl_2(m_2) | ZnCl_2(m_1) | AgCl(s) | Ag$  were measured at 25° and 35° over the concn. ranges 0.5—12.0 and 0.5—9.0M. respectively. Calc. vals. of the transport no.  $n_c$  are tabulated.  $n_c$  becomes negative above 2M. (cf. A., 1939, I, 419). F. L. U.

**Decomposition potentials of lithium chloride, potassium chloride, and magnesium chloride.** H. Grothe and W. Savelsberg (*Z. Elektrochem.*, 1940, 46, 336—346).—Potential-c.d. curves are given for molten LiCl, KCl, and  $MgCl_2$ , and for LiCl-KCl and ternary mixtures, at various temp. between 600° and 900°. The decomp. potentials at 800° (temp. coeff. in parenthesis) are: LiCl 3.17 (1.67  $\times 10^{-3}$ ), KCl 3.10 (1.72  $\times 10^{-3}$ ),  $MgCl_2$  2.49 v. (1.21  $\times 10^{-3}$ ). The single potentials of the metals, calc. for 20°, are: Li —2.96, K —3.10, Mg —2.08 v. F. L. U.

**Polarisation of redox electrodes.** V. Čupr (*Z. Elektrochem.*, 1940, 46, 364—368).—An expression is derived giving the relation between the strength of the polarising current and the polarisation of an electrode the potential of which is determined by the concns. of two components forming a redox system in the solution. The relation is approx. linear when the polarisation is  $> 0.02$  v. F. L. U.

**Rate of dissolution of metals in acids as a function of overvoltage. I. Diffusion potential. II. Dissolution of cadmium in sulphuric acid.** G. E. Kimball and A. Glassner (*J. Chem. Physics*, 1940, 8, 815—820, 820—827).—I. Mathematical. Simultaneous conduction and diffusion through a constrained diffusion layer is discussed. An exact solution is obtained for an ideal dil. solution containing two ionic species, and a numerical solution of the case of bivalent ions diffusing into a uni-bivalent electrolyte. For diffusion layers  $\sim 50 \mu$ . thick the p.d. across the layer for currents of 100 ma. per sq. cm. is  $< 1$  mV., so the diffusion potential can be neglected in comparison with the double layer potential.

II. The rate of dissolution ( $v$ ) of Cd in  $H_2SO_4$  is const. at a given potential and independent of the  $[H_2SO_4]$ . It increases with increasing electrode potential in accord with the theory of Kimball (A., 1940, I, 223). From the variation of  $v$  with the speed of stirring and with the electrode potential it is inferred that the dissolution process is controlled by diffusion. J. W. S.

## VIII.—REACTIONS.

**Reaction of hydrogen atoms with butane.** E. W. R. Steacie and E. A. Brown (*J. Chem. Physics*, 1940, 8, 734—738).—The reaction of H atoms with  $C_4H_{10}$  has been studied at 35—250°. The activation energy is  $9 \pm 1.5$  kg.-cal. per mol. At low temp. the sole product is  $CH_4$ , but at higher temp.  $C_2H_6$  is also formed. The results indicate a mechanism in which a series of at. cracking reactions plays the main rôle, and it is suggested that the primary process is  $H + C_4H_{10} \rightarrow C_2H_5 + H_2$ , followed by further reactions of  $C_2H_5$  with H, whereby smaller free radicals are produced, the  $CH_3$ , and at higher temp. also the  $C_2H_5$ , radicals finally reacting with a  $H_2$  mol. to form  $CH_4$  and  $C_2H_6$ , respectively. J. W. S.

**Application of the theory of absolute reaction rates to heterogeneous processes. I. Adsorption and desorption of gases. II. Chemical reactions on surfaces.** K. J. Laidler, S. Glasstone, and H. Eyring (*J. Chem. Physics*, 1940, 8, 659—667, 667—676).—I. By means of the theory of abs. reaction rates and by regarding adsorption as involving reaction between a gas mol. and an adsorbing centre, equations are



derived for the rates of adsorption and desorption of gases. Combination of these equations gives an adsorption isotherm similar to that of Langmuir. The rate equations and adsorption isotherms for cases in which adsorption is accompanied by dissociation or interaction between the adsorbed mols. are discussed. Equations are also derived for adsorption on covered surfaces.

II. The theory is used to derive equations for the rates of unimol. and bimol. heterogeneous gas reactions under various conditions of covering of the surface. Combined with the energies of activation of the respective reactions these lead to vals. of the rates of decomp. of  $\text{PH}_3$ ,  $\text{HI}$ ,  $\text{N}_2\text{O}$ , and  $\text{NH}_3$ , interaction between  $\text{NO}$  and  $\text{O}_2$ , and  $\text{CO}$  and  $\text{O}_2$ , and dissociation of  $\text{H}_2$  into atoms which are in accord with observed vals. It is suggested that adsorption of the activated complex lowers the overall activation energy of a reaction, and hence favours the surface reaction as compared with the homogeneous reaction. If a product or other substance acting as a poison is strongly adsorbed the activation energy is increased, but some compensation arises from the increase in entropy accompanying the desorption of the poison.

J. W. S.

**Mechanism of reactions involving excited electronic states. Gaseous reactions of the alkali metals and halogens.** J. L. Magee (*J. Chem. Physics*, 1940, 8, 687—698).—Theoretical. The possibility of restriction of the change from homopolar to heteropolar state, or vice versa, during reaction between alkali metals and halogens is discussed, and it is concluded that serious restriction can occur only for interat. reactions. The possibility of the formation of excited alkali metal atoms during these reactions is also discussed.

J. W. S.

**Directed valency in chemical reactions.** J. L. Magee (*J. Chem. Physics*, 1940, 8, 677—687).—Theoretical. The potential energy surfaces for reactions of 2 H atoms in S states with another atom having a single valency electron in a 2p orbital are derived. The activation energies (E) calc. for the reactions  $\text{H}_2 + \text{X} \rightarrow \text{H} + \text{HX}$  ( $^1\Sigma$ ) and  $\text{HX} (^1\Sigma) + \text{H} \rightarrow \text{H} + \text{XH}$  ( $^1\Sigma$ ) (X = atom with electron in 2p orbital) are  $\sim 1$  kg.-cal. per mol., in accord with the vals. observed when X = halogen and with the principle that directed valency decreases E. The symmetrical configurations for the complex  $\text{H}_2\text{X}$  have the lowest energy and are stable with respect to dissociation into either  $\text{HX} + \text{H}$  or  $\text{H}_2 + \text{X}$ . The mechanism of the reaction between  $\text{H}_2$  and halogens is discussed.

J. W. S.

**Sedimentation analysis of nickel catalyst.**—See B., 1940, 872.

**[Hydrogenation] catalysts from alloys; nickel catalysts.**—See B., 1940, 841.

**Hydrogenation. Rôle of the catalyst.**—See B., 1940, 841.

**[Catalytic] hydrogenation of aniline.**—See B., 1940, 842.

**[Catalytic] hydrogenation of petroleum.**—See B., 1940, 836.

**Theory of the potential and technical practice of electro-deposition.**—See B., 1940, 867.

**Quantitative electrodeposition of tin from chloride solutions.**—See B., 1940, 867.

**Electrolytic polishing of stainless steels.**—See B., 1940, 865.

**Relation between Kolbe's reaction and hydrogen-ion concentration.** VIII. R. Matsuda and S. Ikuta (*Bull. Chem. Soc. Japan*, 1940, 15, 322—331; cf. A., 1932, 1214).—Data are recorded for the anodic gas composition and the current efficiency in the electrolysis of solutions containing various proportions of  $\text{H}_2\text{SO}_4$ ,  $(\text{NH}_4)_2\text{SO}_4$ ,  $\text{AcOH}$ , and  $\text{NH}_4\text{OAc}$ . From all solutions containing free acid  $\text{O}_2$  is evolved in quantities increasing with the acidity.  $\text{CO}_2$  is always produced, and  $\text{CO}$  except from neutral solutions. A gas having the composition  $\text{C}_2\text{O}_4$  is stated to be formed in small quantity from solutions that are acidic and that also produce  $\text{C}_2\text{H}_6$ .

F. L. U.

**Electrolytic reduction of phthalic acid.**—See B., 1940, 870.

**Reaction between aqueous iodine and sodium formate.** W. V. Bhagwat (*J. Indian Chem. Soc.*, 1940, 17, 304—307).—The rate of the dark reaction was measured in presence of various salts. With  $\text{KCl}$ ,  $\text{NaCl}$ , and  $\text{NH}_4\text{Cl}$   $k$  first increases with concn. and then falls, indicating that, whilst  $\text{Cl}^-$  is a positive catalyst, the cations retard the reaction in the order  $\text{NH}_4^+ > \text{Na}^+ > \text{K}^+$ . Retardation is also caused by  $\text{K}_2\text{SO}_4$ ,

$\text{KNO}_3$ ,  $\text{NaNO}_3$ ,  $\text{NH}_4\text{I}$ , and  $\text{KI}$ . Measurements of  $k$  for the photochemical reaction in presence and in absence of  $\text{KI}$  confirm previous observations (cf. A., 1934, 156, 1078) that velocity increases less rapidly than light intensity.

F. L. U.

**Photochemical after-effect in the oxalate-iodine reaction.** P. S. MacMahon and B. B. Lai (*J. Indian Chem. Soc.*, 1940, 17, 429—440).—The velocity of the photochemical after-effect in the reaction between  $\text{K}_2\text{C}_2\text{O}_4$  and  $\text{I}$  (in  $\text{KI}$ ) (cf. A., 1937, I, 525) increases continuously with increasing time of pre-illumination. The initial velocity is equal to the rate of photochemical reaction at the instant illumination is removed, but it decreases rapidly at first and then very slowly. After several hr. the velocity is still  $\gg$  that of the normal dark reaction, this effect being the greater the longer is the initial period of illumination, and not being affected appreciably by temp. When fresh  $\text{I}$  is added in the dark to solutions of  $\text{K}_2\text{C}_2\text{O}_4$  and  $\text{I}$ , decolorised by illumination, a "secondary after-effect" is obtained, the velocity of reaction being  $\gg$  that of the dark reaction and decaying with time as with the primary after-effect. This effect is diminished by increasing the time interval between decolorisation and addition of  $\text{I}$ , rise of temp., and increase in the  $[\text{KI}]$ . Slow photochemical reaction occurs between  $\text{H}_2\text{C}_2\text{O}_4$  and  $\text{I}$ , but there is no after-effect. The final solutions obtained by complete reduction of  $\text{I}$  by  $\text{K}_2\text{C}_2\text{O}_4$  do not reduce  $\text{HgCl}_2$ , so it is inferred that the mechanism of the after-effects is not the same as in the reaction between  $\text{H}_2\text{C}_2\text{O}_4$  and  $\text{KMnO}_4$ . An explanation of the effect, based on Berthoud's chain mechanism for the reaction, is suggested.

J. W. S.

**Mercury-photosensitised decomposition of ethane.** IV. Reaction at high temperatures. E. W. R. Steacie and R. L. Cunningham (*J. Chem. Physics*, 1940, 8, 800—804).—The products of the reaction at 100—475° ( $\text{CH}_4$ ,  $\text{C}_2\text{H}_6$ , and  $\text{C}_2\text{H}_4$ ) are similar to those at low temp. (A., 1938, I, 632) and it is inferred that the mechanism is similar. The quantum yield is approx. doubled by rise of temp. from 100° to 475° and no evidence is obtained in favour of a chain reaction.

J. W. S.

## IX.—METHODS OF PREPARATION.

**Method for obtaining powders of uniform sodium chloride crystals in various size ranges, and the effect of size on the intensity of X-ray reflexion.** F. H. Marshall (*Physical Rev.*, 1940, [ii], 58, 642—650).—The reproducible prep. of uniform crystals of any desired size in the range 1—70  $\mu$ . is effected by pptn. with abs.  $\text{EtOH}$  from a saturated aq. solution of  $\text{NaCl}$  with varying excesses of  $\text{H}_2\text{O}$  added to either of the solutions before combining them. Size range and crystal uniformity are controlled by attention to certain primary variables in the pptn. process, each producing marked changes in the character of the powder. Data for the variation with crystal size of the intensity of the 200-reflexion of  $\text{Cu K}\alpha$  radiation are tabulated and plotted, showing that the intensity decreases slightly with increase of crystal size.

N. M. B.

**Composition of the precipitates formed when solutions of tripotassium phosphate and magnesium chloride are mixed.** A. N. Agte, P. A. Archangelski, and N. I. Birger (*J. Gen. Chem. Russ.*, 1940, 10, 295—304).—The composition of the ppts. varies from that of  $\text{MgKPO}_4 \cdot n\text{H}_2\text{O}$  to that of  $\text{Mg}(\text{OH})_2 \cdot 2\text{MgHPO}_4 \cdot x\text{H}_2\text{O}$  as the ratio  $\text{MgCl}_2 : \text{K}_3\text{PO}_4$  rises (0.1x. solutions at 100°).  $\text{Mg}_3(\text{PO}_4)_2$  is not obtained in these conditions.

R. T.

**Effect of heating gypsum on its micro-structure and crystal-optical properties.** V. I. Serdjukov (*J. Gen. Chem. Russ.*, 1940, 10, 359—368).—Three stages are distinguished, (i) 600—1100°, over which the  $d$  of the mass rises, but the anhydrite structure is retained, (ii) 1100—1400°, over which  $n$  rises and crystal structure changes (formation of basic sulphate), and (iii) 1400—1500° and higher, associated with fusion, and with development of a granular structure when the melt solidifies. At >1500° dissociation of  $\text{CaSO}_4$  proceeds rapidly.

R. T.

**Aluminium phosphate.** D. P. Chatterjee (*J. Indian Chem. Soc.*, *Ind. Edit.*, 1940, 3, 85).—The prep. of a form of  $\text{AlPO}_4$  which is insol. in mineral acids is described.

I. A. P.

**Action of metals on water of crystallisation. I. Action of aluminium. II. Action of zinc. III. Structure and properties of crystal hydrates.** V. I. Semischin (*J. Gen. Chem. Russ.*, 1940, 10, 319—327, 328—334, 335—339).—I. Pow-

dered Al-crystal hydrate mixtures evolve  $H_2$  when heated at  $17-200^\circ$ ;  $>51\%$  of the  $H_2O$  reacted with Al in the given conditions, and the same applied to anhyd. acids and acid salts. The reactivity of the  $H_2O$  of crystallisation rises in the orders: Mg, Ba, Sr, Ca, Al,  $Sn^{II}$ , Cd,  $Cu^{II}$ ,  $Cr^{III}$ ,  $Ni^{II}$ ,  $Co^{II}$ ,  $Fe^{II}$ ;  $OAc'$ ,  $B_2O_7''$ ,  $S_2O_3'''$ ,  $SO_4''''$ ,  $SO_3''''$ ,  $PO_4''''$ ,  $P_2O_7''''$ ,  $CO_3''''$ ,  $Cl'$ .

II. The order of increasing reactivity for the corresponding reaction with Zn is: Ca, Sr, Mg, Ba, Cd,  $Cu^{II}$ ,  $Mn^{II}$ ,  $Cr^{III}$ ,  $Sn^{II}$ ,  $Fe^{II}$ , Al,  $Co^{II}$ ,  $Ni^{II}$ ;  $SO_4''''$ ,  $CO_3''''$ ,  $SO_3''''$ ,  $P_2O_7''''$ ,  $B_2O_7''$ ,  $S_2O_3'''$ ,  $Fe(CN)_6''''$ ,  $OAc'$ ,  $Cl'$ .  $>30\%$  of the  $H_2O$  reacts, even in the case of the most reactive salt ( $NiCl_2 \cdot 6H_2O$ ).

III. Of the 144 salts examined, 16 did not react with Mg, Al, or Zn. The reactivity of the metals falls in the order given. The results suggest that  $H_2O$  of crystallisation is partly dissociated, and has a feebly acidic function. R. T.

**Reaction of hydrogen sulphide with sulphites. I. Formation of sodium dithionate by the action of hydrogen sulphide on solutions of sodium sulphite and sodium hydrogen sulphite.** J. I. Zilberman and V. M. Fridman (*J. Gen. Chem. Russ.*, 1940, 10, 347—358).—The products of reaction of  $H_2S$  with aq.  $NaHSO_3-Na_2SO_3$  are  $Na_2S_2O_4$  (chief product),  $Na_2S_2O_6$ ,  $Na_2S_3O_6$ , and  $Na_2SO_4$ . Production of  $Na_2S_2O_4$  and  $Na_2S_2O_6$  is max. with 1:1  $NaHSO_3-Na_2SO_3$ ; that of  $Na_2S_3O_6$  rises as  $[NaHSO_3]:[Na_2SO_3]$  exceeds 1:1. With rising temp. ( $20-100^\circ$ ) production of  $Na_2S_2O_4$ ,  $Na_2S_3O_6$ , and  $Na_2SO_4$  falls, and of  $Na_2S_2O_6$  rises. R. T.

**Hydrates of chromic oxide.** S. I. Djatschkovski and V. K. Rubtsova (*J. Gen. Chem. Russ.*, 1940, 10, 380—384).—Suspensions of  $Cr(OH)_3$  and  $Fe(OH)_3$  were exposed to temp. ranging from  $-182^\circ$  to  $240^\circ$ , and were then filtered at room temp. The composition of the residues was  $Fe_2O_3:H_2O = 1:1$  at  $-182^\circ$  and  $-100^\circ$ ,  $2:3$  at  $-75^\circ$ ,  $1:2$  at  $-50^\circ$  to  $-20^\circ$ ,  $1:3$  at  $-10^\circ$  to  $50^\circ$ ,  $1:2$  at  $100^\circ$ , and  $2:3$  at  $150-200^\circ$ ;  $Cr_2O_3:H_2O = 2:3$  at  $-100^\circ$ ,  $1:2$  at  $-75^\circ$  to  $-50^\circ$ ,  $1:5$  at  $-20^\circ$ ,  $1:3$  at  $-10^\circ$  to  $50^\circ$ ,  $2:5$  at  $100^\circ$ , and  $1:2$  at  $200^\circ$ . R. T.

**Reactions and exchange of active iodine in an inorganic system.** S. Chatterjee and P. Ray (*J. Indian Chem. Soc.*, 1940, 17, 524—525).—When  $HgI_2$  is added to  $NH_4I$  containing radioactive I, and the resulting  $(NH_4)_2HgI_4$  decomposed by dilution with  $H_2O$ , the  $HgI_2$  pptd. is radioactive. Similar results are obtained during the formation and decomp. of  $NH_4BiI_4$  and  $(NH_4)_2PbI_4$ , so it is inferred that there is no essential difference between the normal covalency and the co-ordinate covalency in these compounds. J. W. S.

**Corrosion of steels by molten nitrates.**—See B., 1940, 864.

## X.—ANALYSIS.

**Determination of hydrogen in steel and other metals.**—See B., 1940, 865.

**New test for hydroxylamine by formation of "indo-oxime."**—See A., 1940, II, 382.

**Determination of phosphorus in titanium steels.**—See B., 1940, 865.

**Rapid determination of carbon in coals.**—See B., 1940, 834.

**Colorimetric determination of sodium hyposulphite.**—See B., 1940, 845.

**Spectrochemical analysis of zinc-base alloys.**—See B., 1940, 866.

**Spectrochemical analysis of cadmium in copper.**—See B., 1940, 866.

**Determination of chromium in iron and steel.**—See B., 1940, 865.

## XI.—APPARATUS ETC.

**Abridged spectrophotometers.**—See B., 1940, 828.

**Variables versus constants in emission spectrography.** T. A. Wright (*Amer. Soc. Test. Mat., Preprint* 112, June, 1940, 5 pp.).—The variables in the technique of spectrographic analysis are tabulated with a view to a discussion of their standardisation. R. B. C.

**Glass electrode.** G. E. Shaw (*Quart. J. Pharm.*, 1940, 13, 271—273).—After determination of the  $pH$  of certain protein solutions the glass electrode frequently appears to be contaminated with a film which can sometimes be removed by repeatedly washing with distilled  $H_2O$  and finally wiping with silk. In some cases cleaning with aq.  $CrO_3$  is necessary. It is suggested that two electrodes should be used alternately, the unused being stored in aq.  $CrO_3$ , and a buffer check should be carried out before and after the  $pH$  determination. J. N. A.

**Simplified apparatus for electrophoresis.** S. Tschalkovski (*Kolloid. Shurn.*, 1939, 5, 131—133).—The side prongs of the trident are connected with electrode vessels, and through the middle prong a pipette is introduced which touches the bottom and serves for adding the sol. J. J. B.

**New technique for determining ultrasonic velocities in liquids.** R. L. Narasimhaiya and C. S. Doraiswami (*Indian J. Physics*, 1940, 14, 187—189).—A method has been developed for determining the ultrasonic velocity in liquids by obtaining simultaneously the diffraction pattern over the entire region of the visible spectrum using white light. A superposed Fe arc enables the diffraction angles to be computed for a no. of standard  $\lambda$ . The errors arising in the determination of the focal length of the camera lens are eliminated by using a known transmission grating. In PhMe at  $26.4^\circ$ , and at an ultrasonic frequency of  $5.689 \times 10^6$  Hz, the velocity of sound is  $1314 \pm 2$  m. per sec. W. R. A.

**Titration with a silk fibre.** J. A. Linnik (*Kolloid. Shurn.*, 1938, 4, 689—697).—Owing to its isoelectric point being at  $pH$  5.1 a silk fibre can be used as indicator in acidimetry and alkalimetry by observing its deflexion in an electric field (cf. A., 1934, 143). R. C.

**Platinised glass as a laboratory substitute for massive platinum.** C. C. Coffin (*Canad. J. Res.*, 1940, 18, B, 318—321).—Platinised Pyrex glass can replace massive Pt for many purposes. A platinised Pyrex rod constitutes an electrode which is easily sealed into Pyrex apparatus. F. J. G.

**Continuous vacuum distillation.** M. Burger (*J. Lab. clin. Med.*, 1940, 25, 1221—1224).—A continuous vac. distillation assembly is described and illustrated. C. J. C. B.

[Lamp for use in] identification of war gases.—See B., 1940, 902.

**Nomograph plotting for vapour-pressure and composition data.**—See B., 1940, 828.

## XIII.—GEOCHEMISTRY.

**Incidence of hydrogen sulphide at Kilauea solfatara preceding the 1940 Mauna Loa volcanic activity.** J. H. Payne and S. S. Ballard (*Science*, 1940, 92, 218—219).—Apart from steam, the predominant gas, Kilauea solfataric gases contain  $CO_2$  85—98,  $SO_2$  1—15, and air  $\sim 1\%$ . Irregular variations have occurred in the ratio  $SO_2:CO_2$  during the two years under investigation. Just before and during the first few weeks of the Mauna Loa activity, traces of  $H_2S$  appeared in the solfataric gas. L. S. T.

**Loss of heat by conduction from the earth's crust in Britain.** E. M. Anderson (*Proc. Roy. Soc. Edin.*, 1940, 60, 192—209).—Temp. measured at various depths in the 1007 m. Boreland Bore (*Geol. Survey File* 36 NW, No. 52) are recorded. The equilibrium heat flow is calc. to be  $1.28 \times 10^6$  g.-cal. per sq. cm. per sec. This val. agrees with those obtained in most other parts of Britain. O. D. S.

**Calcite nodules in Keuper marl at Upton, Wirral.** W. Schofield (*Proc. Liverpool Geol. Soc.*, 1940, 18, 4—6).—The occurrence of nodules of calcite in cavities in the marl is described, and their origin discussed. L. S. T.

**Composition of the Upton nodules.** J. Caspell (*Proc. Liverpool Geol. Soc.*, 1940, 18, 7—8).—The nodules described previously (cf. preceding abstract) consist of  $CaCO_3$  98.7 and  $MgCO_3$  1.3%. The host rock is composed of sand + clay 82.1,  $Fe_2O_3(+Al_2O_3)$  6.7,  $CaCO_3$  2.8,  $MgCO_3$  4.2, and  $H_2O$  2.1, total 98.6%. L. S. T.