# BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

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

### AUGUST, 1939.

Stark effect of Balmer lines after passage of the atoms through a very strong electric field. R. RITSCHL (Physikal. Z., 1939, 40, 413—415).—If H positive rays traverse a transverse electric field sufficiently strong to remove the red Stark-effect components by ionisation, only violet-displaced components are observed when the longitudinal field is decreased. If, after passage through the ionising field, the direction of the field is reversed in a second field condenser, only the violet-displaced components are again observed in the second field space. If the positive rays pass through a space without field, after passing through the strong ionising field, the atoms emit only violet-displaced components when the field is again increased. A. J. M.

functions of mercury. P. VETTERLEIN (Ann.

Comparative measurements on the Stark effect of deuterium and hydrogen. W. STEUBING, A. KEIL, and F. STOLPE (Z. Physik, 1939, 112, 560— 568).—Determinations of the separations for H and D, using high dispersion, fail to reveal the predicted difference. Both H and D show the expected asymmetry of the photographed image, due to the fine structure splitting of the Balmer levels. Differences in the intensity ratios of the single components are confirmed. Under identical conditions of examination the D components are less sharp than the H.

L. G. G.

Variation in intensities of spectral lines with direction of observation of the Stark effect. H. KUBOTA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, 36, 7—11).—A theoretical expression has been obtained for the relative intensities when viewed at an arbitrary angle and compared with the experimental results given by a Lo Surdo tube having a rotating axis. The agreement is satisfactory.

[Y. ISHIDA.] The  $\Delta m$  selection rule for the transverse effect cannot hold if the condensing lens has a large aperture and so collects beams which are not parallel to the optic axis. T. H. G.

Absorption spectrum of oxygen. L. HERMAN (Ann. Physique, 1939, [xi], 11, 548—611).—A column of 100 m. of gas was employed and the very feeble absorption in the visible and ultra-violet regions has been studied. Spectra due to  $O_2$ ,  $O_3$ , and  $O_4$  are discussed. W. R. A.

Stark effect of the Ne II spectrum. Y. ISHIDA, T. TAMARU, and G. KAMIJIMA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, 36, 12—30).—Measurements have been made using the Be cathode in a Lo Surdo quartz tube and many lines due to the 3d-nx transitions have been recorded. Their Stark effects resemble that of He. Normal coupling seems to be observed by the lower configurations but as n increases jj-coupling appears to obtain. The abs. term vals, have been calc. T. H. G.

Limiting continuum of the principal series of sodium. J. BOTT (Ann. Physik, 1939, [v], 35, 314—328).—At. absorption coeffs. of Na in the limiting continuum of the principal series have been measured and agree with theory (cf. Trumpy, A., 1931, 1203). The photoionisation of Na cannot be measured by the space-charge method using a Na–W cathode, owing to the small electron emission of the cathode (cf. Bott, *infra*). O. D. S.

Effect of foreign gases on the continuous absorption spectrum of bromine. N. S. BAYLISS and A. L. G. REES (Trans. Faraday Soc., 1939, 35, 792—800).—A full description of work already reported (A., 1939, I, 289). F. L. U.

Constitution of the hot-cathode discharge in the neighbourhood of hollow hot cathodes. E. F. RICHTER (Z. tech. Phys., 1936, 17, 306—315; Chem. Zentr., 1936, ii, 3987).—Results of Langmuir probe tests are described and discussed. The potential distribution corresponds with that found by Compton and Eckart for a low-voltage arc with a filament cathode. The variation of potential, electron temp., and current distribution with various factors is also studied. A. J. E. W

Energy transfer by elementary collision processes. H. SCHÜLER and H. HABER (Z. Physik, 1939, 112, 614—625; cf. A., 1939, I, 177).—A discussion of collision processes in the discharge in gases, *e.g.*, BiH. L. G. G.

Isotope shift of spectral lines. I. E. TAMM (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 764).— The magnitude of short-range interaction between electrons and neutrons required to account for isotope shifts of spectral lines is of the same order as that already suggested by the author. L. J. J.

Effect of positive ions on an electron current limited by space charge. J. BOTT (Ann. Physik, 1939, [v], 35, 329—332).—Theoretical. The effect of positive ions on the electron space charge at a plane electrode is calc. Kienzle's results (cf. A., 1937, I, 592) can be explained by the space-charge effect of the positive ions on the potential distribution before the cathode. O. D. S.

Observation of radiations of low intensity in the neighbourhood of a bright spectrum line. A. COUDER and P. JACQUINOT (Compt. rend., 1939, 208, 1639—1641).—The obscuring of a weak satellite by diffracted light from a more intense line is considered. The use of a slit only slightly longer than its width, and of a square diaphragm diagonal to the axis of dispersion, is advantageous. A. J. E. W.

Measurement of the natural width of X-ray lines. G. ORTNER and R. ZENTNER (Sitzungsber. Akad. Wiss. Wien, IIa, 1935, 144, 437-453; Chem. Zentr., 1936, ii, 3878).—The half-val. widths (w) of the K-lines of Fe, Ni (first-order), Cu, and Co (firstand second-order) have been measured with a single (calcite) crystal spectrometer. w falls with increasing Z, as found by Allison (A., 1933, 881). The secondorder w vals. are very small (Cu-K $\alpha_1$ , 0.52 A.). The calculation of the true natural width of the lines is discussed. A. J. E. W.

Auger effect and L emission lines. A. HAUTOT and H. SAUVENIER (Compt. rend., 1939, 208, 1565— 1566).—The apparent broadening of the  $L_{II, III}$ emission lines of Na, Mg, and Al may be due to the occurrence of the Auger effect at the instant of radiation. The probability of the effect for the  $L_{I}$  band of Na is high, and the  $L_{I}$  line may be very broad and of low intensity. The  $L_{II, III}$  band of Al is abnormally broad, and non-parabolic. A. J. E. W.

Discharge voltage variations in molecular gases due to irradiation. W. FUCHS and G. SCHUMACHER (Z. Physik, 1939, 112, 605—613).—The relation between discharge potential and current due to irradiation of the cathode with ultra-violet light is examined. L. G. G.

Electron interferences at light molecules by the sector method. P. P. DEBYE (Physikal. Z., 1939, 40, 404—406).—The sector process (A., 1939, I, 130) has been improved, and photographs obtained with  $CCl_4$ ,  $CS_2$ ,  $C_2H_2$ , and  $NH_3$  are reproduced and discussed. A. J. M.

Back-diffusion of fast electrons in narrow channels. Production of sharp luminous spots in X-ray tubes. F. OSWALD (Z. tech. Phys., 1936, 17, 41-44; Chem. Zentr., 1936, ii, 933).---Difficulties due to spurious excitation by reflected electrons are discussed. A tube-form hollow cathode giving a sharp spot is described. A. J. E. W.

Normal and abnormal  $\delta$ -rays. D. SKOBELTZYN (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 759— 760).—Two distinct types of secondary electrons are produced in N<sub>2</sub> by  $\beta$ -rays of energy 1—3 e.Mv. The properties of normal  $\delta$ -rays agree with an elastic collision mechanism, with a probability of formation in accordance with Møller's formula, indicating normal electronic diffusion. L. J. J.

Spatial distribution of ionic clouds produced by photo-absorption and scattering absorption in the ionisation of air by X-rays. I. H. KÜSTNER (Ann. Physik, 1939, [v], 35, 153—192).—The total ionisation produced by X-rays of varying hardness in air has been analysed into components produced by Compton electrons and photo-electrons, by differentiation of ionisation-radius curves for axiallyirradiated cylindrical chambers. L. J. J. Measurements of the electrical excitation functions of mercury. P. VETTERLEIN (Ann. Physik, 1939, [v], 35, 251–271).—The velocity distribution of electrons produced by inelastic collisions has been measured by a method which is described, and excitation functions of Hg between 100 and 380 v. are given. W. R. A.

Effects produced by bombarding a metallic surface with fast electrons. J. TRILLAT and R. MERIGOUX (J. Phys. Radium, 1939, [vii], 10, 245— 249).—On allowing fast electrons (20—60 kv.) to impinge on a metal surface the point of impact can be detected visually. Further, this point is now passive to chemical reagents and does not exhibit the characteristic diffraction patterns of the metal. This effect is interpreted as arising from the deposition of C produced from vapours of hydrocarbons always present in the greased joints of the apparatus. W. R. A.

Inner motion of the electron. I. H. HÖNL and A. PAPAPETROU (Z. Physik, 1939, 112, 512-540).— Theoretical. L. G. G.

Radiative corrections for electron scattering. S. M. DANCOFF (Physical Rev., 1939, [ii], 55, 959— 963).—Mathematical. A relativistic treatment. N. M. B.

Secondary electron emission. H. NELSON (Physical Rev., 1939, [ii], 55, 985).—Since available data indicate that the high secondary-to-primary ratios  $\delta$  for electropositive metals are characteristic of contaminated rather than clean surfaces, it is suggested that the existence of a positive charge in surface films may influence the secondary-electron emission characteristics. An experimental curve of  $\delta$  as a function of primary electron velocity for a film of MgO on nichrome shows a marked inflexion in the region of low potentials corresponding with a transformation from negative to positive charge in the insulating film, N. M. B.

Secondary electron emission due to  $H_2^+$  and  $D_2^+$  ions. (MISS) M. HEALEA (Physical Rev., 1939, [ii], 55, 984; cf. A., 1936, 1041).—For ions of energies 300—1500 ev. emissions due to bombardment of a hot Ni target varied approx. linearly  $13\cdot1-44\cdot7\%$  for  $H_2^+$  and  $12\cdot2-35\cdot7\%$  for  $D_2^+$  over the energy range. Emission curves are given and discussed. N. M. B.

Absorption of high-energy electrons. K. D. SINELNIKOV, A. K. WALTHER, A. J. TARANOV, A. V. IVANOV, and U. S. GUMENIUK (Bull. Acad. Sci. U.R.S.S., 1938, Sér, Phys. 747—755).—Ranges of electrons of energy 0.4—2.3 e.Mv. in Li, C, Al, Cu, and Pb have been measured, and sp. rates of energy loss determined. These agree with Bloch's formula for Li and C, but heavier atoms give losses > the theoretical vals. (2—3 times greater for Pb). The discrepancy  $\propto Z^2$ , and is independent of the initial energy.

L. J. J. **Energy losses of fast electrons.** L. A. ARTZIMO-VITSCH and V. A. CHRAMOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 757—759).—Results in agreement with theory have been obtained for energy losses of electrons of energy 1—2.65 e.Mv. in C, Al, Cu, and Pb, by the use of a double focussing magnetic monochromator. L. J. J.

Conditions for producing intense ionic beams. L. P. SMITH and G. W. SCOTT, jun. (Physical Rev., 1939, [ii], 55, 946—953).—Mathematical. Conditions for optimum production of positive ions and their complete removal from the ionisation region to form a beam are developed. Account is taken of the variation in ionisation cross-section as a function of electron energy. The mechanism of proton production is considered and the efficiency of arc type sources is discussed. N. M. B.

Focussed beam source of hydrogen and helium ions. G. W. SCOTT, jun. (Physical Rev., 1939, [ii], 55, 954—959).—Based on the analysis previously reported (cf. preceding abstract), an ion source of high intensity in which the ions are produced by bombarding a region of gas by a focussed beam of electrons is described. An expression for the emission from the ring-shaped cathode used is given, and the emission-voltage curve calc. from this expression is compared with experiment. Curves of total ion vield plotted against electron emission, electron energy, and pressure, and a mass spectrographic analysis of H and He ion beams, are given. Electron beams of 2.2 amp. per sq. cm. and H ion beams of 4 ma. are reported. Proton yields are 5-80% of the total H ion beam. The He<sup>++</sup> yield in the He ion beam is  $\sim 5\%$  of the total beam current. N. M. B.

Detection of single positive ions, electrons, and photons by a secondary electron multiplier. J. S. ALLEN (Physical Rev., 1939, [ii], 55, 966—971).— A tube having 12 electrodes covered with a thin layer of Be, and, with 330 v. per stage, multiplying the primary current by a factor  $10^5$ , is described. Ions of energies 50—20,000 ev. and masses 1—32 were detected. By increasing the gain of the thermionic amplifier electrons could be counted, and, with still more gain, single photons. As the pressure in the counter is  $10^{-6}$  mm., it can be connected directly to the vac. system through which the electrons or ions are accelerated. N. M. B.

Chemical studies by means of molecular beams. VIII. Method of measuring the intensity of potassium atomic beams with an incandescent tungsten surface. K. KODERA (Bull. Chem. Soc. Japan, 1939, 14, 141-147).—The difference between the efficiency of ionisation obtained by flashing K atoms deposited on a W surface and that calc. disappears if the correct vals. of the work function and of the contact potential of the W surface are used. Migration of adsorbed K atoms on the surface of W ribbon heated to 500-700° enables a high surface concn. to be reduced and produces better or even complete ionisation. A simple method for measuring the activation energy of surface migration is proposed. W. R. A.

(A) Scattering of protons by protons. R. G. HERB, D. W. KERST, D. B. PARKINSON, and G. J. PLAIN.
(B) Analysis of experiments. G. BREIT, H. M. THAXTON, and L. EISENBUD (Physical Rev., 1939, [ii], 55, 998-1017, 1018-1064).-(A) Available

scattering cross-section data for angles  $15-45^{\circ}$  (cf. Tuve *et al.*, A., 1937, I, 5) are extended to energies 860-2392 ke.v. and results are compared with Mott vals. The ratio of the two sets of vals. rises with increasing angle and proton energy. At 1830 ke.v. measurements were made at scattering angles up to 60° and the scattering showed the theoretically expected asymmetry about 45°. As a check on the proton-proton measurements the scattering of protons from A and Kr with protons of energies 850-2440 ke.v. was investigated.

(B) A comprehensive analysis and discussion of available data. N. M. B.

Approximate equality of the proton-proton and proton-neutron interactions for the meson potential. G. BREIT, L. E. HOISINGTON, S. S. SHARE, and H. M. Thaxton (Physical Rev., 1939, [ii], 55, 1103).—New data on scattering cross-section (cf. Simon, A., 1939, I, 293) and new proton-proton scattering experiments (cf. preceding abstract) indicate a still closer equality of the two interactions, and that this equality becomes almost perfect for the meson type of potential. N. M. B.

Ionisation by collisions of positive ions. J. S. TOWNSEND (Phil. Mag., 1939, [vii], 28, 111-117). —A theoretical discussion. T. H. G.

At. wt. of chlorine arising from industrial residues. P. DUTOIT and K. V. YACOUBYAN (Helv. Chim. Acta, 1939, 22, 805–808).—The at. wt. of Cl from old NaCl and KClO<sub>3</sub> electrolytic baths is indistinguishable from that of ordinary Cl. Residual  $Cl_2$  from a  $Cl_2$ -distillation plant appears to have an at. wt. 0.007% > that of normal Cl, but this difference is at the limit of experimental error. A method of determining the at. wt. of Cl by potentiometric titation with AgNO<sub>3</sub> is described. J. W. S.

At. wt. of iron. O. HÖNIGSCHMID and S. C. LIANG (Z. anorg. Chem., 1939, 241, 361–371).—From the ratios  $\text{FeBr}_2 : 2\text{Ag} : 2\text{AgBr}$  the most probable val. is 55-850. Reasons are given for preferring this to the International val., 55-84. F. J. G.

Isotope separation by thermal diffusion. W. H. FURRY, R. C. JONES, and L. ONSAGER (Physical Rev., 1939, [ii], 55, 1083—1095).—Mathematical. The theory of the process in an apparatus with two concentric tubes is developed. The equations for the convection and diffusion processes lead to an expression for the net transport of a single isotope, valid for arbitrary macroscopic properties of the gas. The transport equation is applied to separation factor and speed of operation for discontinuous running, and also for continuous flow of gas through the tube. The advantages of the two methods are compared and the concn. of <sup>13</sup>C by the use of  $CH_4$  is considered.

N. M. B.

Activity of mesothorium free from radium. (MME.) S. COTELLE and L. WINAND (J. Chim. phys., 1939, 36, 73—77).—The  $\gamma$ -radiation and heat evolution were measured over a period of 60 days. Analysis of the curves is in agreement with theory. F. L. U.

Stopping power of mica for α-particles of small range. W. RIEZLER (Ann. Physik, 1939, [v], 35, 350—353; cf. Bennett, A., 1936, 1172).—The air equiv. of mica and the energy loss in mica for Po  $\alpha$ -particles of range 4—25 mm. have been measured. The air equiv. decreases by 12% with decreasing  $\alpha$ -particle range. O. D. S.

Ionisation and range of  $\alpha$ -particles in sulphur hexafluoride. W. RIEZLER (Ann. Physik, 1939, [v], 35, 354—358).—SF<sub>6</sub> is a suitable gas for filling small ionisation chambers. The relative stopping power for Po  $\alpha$ -particles is  $3.91\pm0.06$ , and the mean ionisation for 3-Me.v.  $\alpha$ -particles is 1.08 (air 1.00). The stopping power and ionisation are not strictly proportional. O. D. S.

Total and specific ionisation of Po alphaparticles and their statistical fluctuations. J. M. W. MILATZ and G. A. W. RUTGERS (Physica, 1939, 6, 529—550).—Measurements of the ionisation produced by  $\alpha$ -particles from Po were made in a shallow and in a deep chamber with varying distances from source to chamber. A method of allowing for the scattering of the ranges and amounts of ionisation produced by individual particles is described; it permits the mean ionisation curve of a particle of a given range to be determined. This is independent of the range for the last few cm. of the path. The ionisation per unit length of path is  $\infty$  the loss of energy of the particle. L. J. J.

Interpretation of  $\beta$ -disintegration data. A. I. ALICHANIAN and V. BERESTEZKY (Physical Rev., 1939, [ii], 55, 978).—A discussion of the difficulties arising from Bethe's method (cf. A., 1939, I, 231) of interpreting  $\beta$ -disintegration data on the basis of Fermi's theory. N. M. B.

Absorption method for determining the range of recoil atoms. E. E. WIDDOWSON and S. J. GREGG (Nature, 1939, 143, 760—761).—Methods for determining the absorption curves and recoil ranges of atoms resulting from  $\alpha$ -particle disintegrations which immediately precede a  $\beta$ -particle disintegration are described. Built-up films of Ba stearate on stainless steel are used to provide absorbent screens of suitable thinness. L. S. T.

 $\gamma$ -Ray ion currents in air at high pressures and high gradients at high and low temperatures. J. W. BROXON and G. T. MERIDETH (Physical Rev., 1939, [ii], 55, 883-893).-Investigations previously reported (cf. A., 1938, I, 426) were extended to temp. -76° and 96° at pressures up to 193 atm., and full data are plotted and discussed. Observed temp. coeffs. of the currents agree well in dependence on temp. and gas density with the predictions of the initial recombination theory and of the columnar theory at low collecting field intensities, and depend on field intensity as required by the columnar theory. The coeff. in Zanstra's equation (based on the Jaffé columnar theory) is modified to correspond with the new temp. N. M. B.

Interaction of fast neutrons with protons. E. O. SALANT, R. B. ROBERTS, and P. WANG (Physical Rev., 1939, [ii], 55, 984—985).—The neutron–Č and neutron–proton cross-sections measured for neutrons of ~15 Me.v. energy were  $1.13 \times 10^{-24}$  and  $0.61 \times 10^{-24}$  sq. cm., respectively. The theoretical neutron–

proton cross-section, evaluated from the phase shifts, agreed exactly with experiment. N. M. B.

Neutron measurements with boron trifluoride counters. S. A. KORFF and W. E. DANFORTH Physical Rev., 1939, [ii], 55, 980).—Cu cylinders in glass envelopes with a central W wire and filled with BF<sub>3</sub> at 2—20 cm. pressure are used as counters and their characteristics are described. A slow neutron produces an  $\alpha$ -particle by disintegration of the B nucleus and the  $\alpha$ -particle produces a large amount of ionisation in the counter, as compared with that due to cosmic rays or  $\gamma$ -ray secondaries. By setting to record only the larger pulses, the  $\alpha$ -particles are counted to the exclusion of  $\beta$ - or  $\gamma$ -counts. N. M. B.

Excess of neutrons from a Ra- $\alpha$  + Be source surrounded by beryllium. Z. OLLANO (Nuovo Cim., 1938, 15, 604—608).—With a source surrounded by Be there are formed, in addition to the neutrons from the source and the photo-neutrons produced by the  $\gamma$ -rays, high-energy neutrons which are probably due to the process: <sup>9</sup>Be +  $n = {}^{8}Be +$ n + n. O. J. W.

Neutron spectrum of Po + Be. G. BERNARDINI and D. BOCCIARELLI (Ric. sci. Progr. tecn., 1936, [ii], 7, II, 89—92; Chem. Zentr., 1936, ii, 4088; cf. A., 1937, I, 161).—Neutron groups with max. energies of 4.2, 7.7, and 6.5 (?) Me.v. are observed. It is assumed that the effective cross-section of a neutron for collision with a proton is inversely  $\infty$  its velocity. A scheme of energy levels, including the neutron group (11 Me.v.) corresponding with the ground state of  ${}^{16}_{6}$ C, is given. A. J. E. W.

Movement of neutrons in substances containing hydrogen. E. FERMI (Ric. sci. Progr. tecn., 1936, [ii], 7, II, 13-52; Chem. Zentr., 1936, ii, 4087— 4088).—A theoretical discussion of various collision and diffusion phenomena and of the production of thermal neutrons, based on a quantum-mechanical analysis of elastic and inelastic collisions between neutrons and protons or H atoms. A. J. E. W.

**Transmission of slow neutrons through crystals.** M. D. WHITAKER and H. G. BEYER (Physical Rev., 1939, [ii], 55, 1101).—A comparison of measurements of cross-sections for slow neutron transmission through polycryst. and single-crystal Fe, Ni, SiO<sub>2</sub>, and permalloy shows that the materials are much more transparent when in the form of single crystals. The bearing of this on the non-additive property of the cross-sections of constituent elements of compounds is discussed. N. M. B.

Forward scattering of neutrons by paramagnetic media. J. H. VAN VLECK (Physical Rev., 1939, [ii], 55, 924—930).—Mathematical. Exchange forces are investigated. It is shown that the exchange interaction between the paramagnetic ions tends to make the scattering inelastic, and reduces the form factor for forward scattering so that it is no longer unity. A calculation of this reduction is attempted, and the distribution of energy changes in the inelastic process is estimated. Results indicate that in MnS, a typical material with appreciable exchange coupling, the form factor reduces the scattering of monochromatic liquid-air and roomtemp. neutrons near the forward direction by  $\sim 75$  and 50%, respectively. N. M. B.

Magnetic scattering of neutrons. O. HALPERN and M. H. JOHNSON (Physical Rev., 1939, [ii], 55, 898—923).—Mathematical. A comprehensive development of previous considerations (cf. A., 1937, I, 438, 489) and suggestions for a series of experiments based thereon. N. M. B.

Volcanic phenomena and nuclear chemistry. J. NOETZLIN (Compt. rend., 1939, 208, 1662—1664; cf. A., 1939, I, 392).—A development of a theory of the production of volcanic eruptions by the energy of chain disintegration reactions induced by neutrons. A. J. E. W.

Formation of helium of mass 3 in an excited state. T. W. BONNER (Nature, 1939, 143, 681).— Cloud chamber experiments with the D-D reaction in He or  $CH_4$  show that a high-energy and a low-energy group of neutrons arise from the reaction  $D + D \rightarrow {}^{3}\text{He} + {}^{1}n$ . The  ${}^{3}\text{He}$  nucleus is left in an excited state at 1.84 e.Mv. in ~15% of the disintegrations. The low-energy group is not produced by scattered neutrons; a low-energy neutron may be emitted when  ${}^{3}\text{He}$  in an excited state is formed.

L. S. T.

Threshold value of the photo-electric disintegration of beryllium. K. D. SINELNIKOV, A. K. WALTHER, V. S. GUMENIUK, and A. V. IVANOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 781— 784).—The nuclear photo-electric effect in <sup>9</sup>Be irradiated with hard X-rays shows a threshold val. of  $1.760\pm0.015$  e.Mv. The cross-section of <sup>9</sup>Be for any disintegration by electrons of energy up to 2.3 e.Mv. is shown to be smaller by several orders of magnitude than that for photons of the same energy. L. J. J.

The "slow" Wilson chamber. H. MAIER-LEIENITZ (Z. Physik, 1939, 112, 569—586).—A chamber employing a liquid piston for expansion purposes, which is used in conjunction with a cinécamera for photographing tracks, is described. No electrons are produced by reaction of neutrons with matter. The  $\gamma$ -spectrum of 7Be shows a single line at 425 e.kv., the decay of 7Be being due to electron capture with production of an excited 7Li. After 35 min. behind Pb, 5 mesotrons of mass about 100 × electronic appeared in the chamber. Conditions for production of mesotrons are discussed. L. G. G.

**Distribution of nuclear levels.** I. I. GUREVITSCH and G. R. RIK (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 771—780).—The excitation curve for the  $(\alpha, n)$  process in <sup>9</sup>Be with  $\alpha$ -particle energies  $\leq 8.8$ e.Mv. shows resonance max. at 3.7, 7.7, and 8.6 e.Mv., the two latter lying above the potential barrier of <sup>9</sup>Be, indicating intermediate formation of <sup>13</sup>C, which has levels at 13.1, 15.8, and 16.5 e.Mv., farther apart than is predicted by statistical theory. The mean intervals between levels for the resonance capture of slow neutrons are calc. as ~15 e.v., 3 e.v., and 8—10 e.v. for groups of elements of mean at. wt. 110, 160, and 195, respectively; the rare-earth region shows a max. density of such levels. L. J. J.

Difference in Coulomb energy of light isobaric nuclei. J. G. Fox, E. C. CREUTZ, M. G. WHITE, and L. A. DELSASSO (Physical Rev., 1939, [ii], 55, 1106).— By determining the upper limit of the positron spectrum the difference in binding energy may be directly measured for two isobars of the type containing an excess of one proton or one neutron, and these can be formed by the endothermic (p,n)reaction. Investigations in the range  ${}^{19}\text{Ne}{}^{-23}\text{Mg}$ , and anomalies beyond this point, are briefly reported with special reference to  ${}^{19}\text{F}(p,n){}^{19}\text{Ne}, {}^{23}\text{Na}(p,n){}^{23}\text{Mg}$ , and  ${}^{21}\text{Ne}(p,n){}^{21}\text{Na}.$  N. M. B.

Concentration of radiophosphorus <sup>32</sup><sub>15</sub>P by an electric field. J. GOVAERTS (J. Chim. phys., 1939, **36**, 130–139).—A detailed account of work already noted (A., 1938, I, 339, 427). W. R. A.

Emission of  $\gamma$ -rays from fluorine under proton bombardment. P. I. DEE, S. C. CURRAN, and J. E. STROTHERS (Nature, 1939, 143, 759—760).—The resonance features of the  $\gamma$ -ray emission from F under proton bombardment may be the result of the formation of excited  ${}^{16}O^*$  nuclei according to the process  ${}^{19}F + {}^{1}H \rightarrow ({}^{20}Ne^*) \rightarrow {}^{16}O^* + {}^{4}He \rightarrow {}^{16}O + {}^{4}He + hv$ , the same excited state of  ${}^{16}O$  (at  $6 \cdot 5 \times 10^6$  e.v.) being produced for each resonance of the  $\gamma$ -ray excitation curve. L. S. T.

**X-Ray emission from the isomers of radioactive bromine.** L. I. ROUSSINOV [RUSINOV] and A. A. YUSEPOVICH [JUZEFOVITSCH] (Physical Rev., 1939, [ii], 55, 979).—Soft radiation emitted in the disintegration of the radioactive Br nucleus was measured by a Geiger-Müller counter, and results of selective absorption in As and Se agree with calc. absorption coeffs. for the  $K\alpha_1$  and  $K\alpha_2$  lines of Br. Absorption curves in Pb and Hg show that the radiation is due to the conversion of the Br nucleus during nuclear isomerism. N. M. B.

Isomerism of bromine. L. I. RUSINOV and A. A. JUZEFOVITSCH (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 765—770).—The disintegration of the radioactive Br of 4-hr. period is followed by emission of a soft radiation. L. J. J.

**Radiobromine.** R. E. SIDAY (Nature, 1939, **143**, 681).—Measurements in a Wilson chamber of tracks starting from thin foils activated with 4.5-hr. radio-Br, and from active EtBr, show homogeneous energy groups of electrons due to the K and Lconversion of the  $\gamma$ -ray, superimposed on a background of the continuous  $\beta$ -ray spectrum of the  $\beta$ -active isotope. The  $\gamma$ -rays have an energy of 43,000 e.v. L. S. T.

 $\gamma$ -Rays from radioactive iodine (<sup>128</sup>I). M. A. BAK and N. N. NIKOLAEVSKAJA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 312—315).—Radioactive <sup>128</sup>I has been prepared by bombarding EtI with slow neutrons ejected from Be, and extracted by pptn. with AgNO<sub>3</sub>.  $\gamma$ -Rays were detected in the products of  $\beta$ -disintegration of this <sup>128</sup>I and their energies found to be  $\sim 4-5 \times 10^5$  e.v. The ratio of  $\gamma$ -quanta to  $\beta$ -rays is 1:2 or 3. T. H. G.

Unsuccessful search for transuranic elements. E. SEGRÈ (Physical Rev., 1939, [ii], 55, 1104— 1105).—The activity produced in a thin U layer by neutrons is of two types : recoiling, containing only fission products, and non-recoiling containing a 23min. and a 2-day period (cf McMillan, A., 1939, I, 235). Since transuranics would certainly be found in the non-recoiling fraction, a detailed chemical and decay investigation of the two activities is described. Results indicate that the 23-min. U decays to a long-life 93 isotope and that there is no evidence of a transuranic element.  $U_3O_8$  irradiated over 2 years showed no unusual  $\alpha$ -activity to indicate a long-life emitter. N. M. B.

Existence of trans-uranium elements. I. Nonexistence of eka-platinum and eka-iridium. O. HAHN and F. STRASSMANN (Naturwiss., 1939, 27, 451—453).—The element with half-life 2.5 hr., formerly called eka-Pt, is not a trans-U element, but an isotope of I. Its half-life is more accurately 2.3 hr. The element with half-life 66 hr., formerly thought to be eka-Ir, consists of two elements with the same half-life. One is a Te isotope, and gives rise to the I isotope of half-life 2—3 hr. Chemical analysis shows the other to be a Mo isotope, probably identical with that obtained by irradiation of Mo with neutrons or deuterons. A. J. M.

Concentrating the uranium isotope of 23minute half-life. J. W. IRVINE, jun. (Physical Rev., 1939, [ii], 55, 1105).—A method of concentrating U (23 min.) with respect to  $^{238}$ U depends on the easier hydrolysis of U<sup>IV</sup> than of U<sup>VI</sup> salts. The prep. of NaUO<sub>2</sub>(OAc)<sub>3</sub> from activated NH<sub>4</sub>UO<sub>2</sub>(OAc)<sub>3</sub> is described in detail and increased concn. by a factor of 10 is found. N. M. B.

Simple capture of neutrons by uranium. H. L. ANDERSON and E. FERMI (Physical Rev., 1939, [ii], 55, 1106-1107; cf. A., 1939, I, 294).-The contribution of the process of simple capture of slow neutrons giving rise to U (23 min.) to the capture of thermal neutrons was investigated in order to determine whether this absorption could account for the difference between the total capture cross-section and the fission cross-section. Measurements based on a determination of the no. of disintegrations per sec. of U (23 min.) produced by thermal neutrons and of the no. of thermal neutrons effective under the conditions of irradiation are described. The vals. found are : fission cross-section  $2 \times 10^{-24}$ , cross-section for simple capture  $1.2 \times 10^{-24}$ , and total absorption cross-section for thermal neutrons  $3.2 \times 10^{-24}$  sq. cm. compared with the val.  $5 \times 10^{-24}$  sq. cm. available from absorption measurements. N. M. B.

Possibility of the disintegration of very heavy nuclei into two nuclei of medium weight. U. FANO (J. Phys. Radium, 1939, [vii], **10**, 229–233).— Theoretical. Assuming that heavy nuclei have a spherical form it can be shown that they are unstable and consequently easily disrupt into two nuclei of medium wt., in agreement with the experimental evidence of Hahn on the artificial radioactivity of U. Possible mechanisms for the fission of stable heavy nuclei by neutron bombardment are reviewed.

W. R. A. Penetrating β-particles from uranium activated by neutrons. H. H. BARSCHALL, W. T. HARRIS, M. H. KANNER, and L. A. TURNER (Physical Rev., 1939, [ii], 55, 989).—Using two counters with a circuit for recording coincidences, measurements were made for U irradiated with fast D–D neutrons, with 1·3 mm. of Al between the U and the counters (to exclude U- $X_2$   $\beta$ -rays). An analysis of coincidence curves from somewhat inconclusive data indicated the presence of activities ( $\beta$ -rays of energy >2.9 Me.v.) of half-lives 11—15, 3·0—4·0, and 0·3—0.9 sec. N. M. B.

Splitting of heavy nuclei by slow neutrons. J. FRENKEL (Physical Rev., 1939, [ii], 55, 987).— Mathematical. An examination of energy relations leads to three different ways of regarding the explosive rupture process. N. M. B.

Conditions of chain transmutation of uranium. F. PERRIN (Compt. rend., 1939, 208, 1573—1575).— The crit. dimensions for unlimited branching of the chains in the rupture of U by neutrons are calc. for a mass of a U prep. containing H and Cd (cf. A., 1939, I, 351). The crit. radius for a sphere of  $U_3O_8$  containing 3% of  $H_2O$  and 0.01% of Cd is 65 cm. at room temp., or 80 cm. at 900°. A. J. E. W.

Production of neutrons by the fission of uranium. J. L. MICHIELS, G. PARRY, and G. P. THOMSON (Nature, 1939, 143, 760).—Experiments showing that the processes of fission of the U nucleus by fast and possibly by slow neutrons lead to a net gain in the no. of neutrons are described. L. S. T.

Number of neutrons liberated in the nuclear fission of uranium. H. VON HALBAN, jun., F. JOLIOT, and L. KOWARSKI (Nature, 1939, 143, 680).— A discussion of previous results (A., 1939, I, 233). The average no. of neutrons produced in every nucleus split is  $3.5 \pm 0.7$ . L. S. T.

Neutrons produced by the disintegration of the uranium nucleus. G. VON DROSTE and H. REDDE-MANN (Naturwiss., 1939, 27, 371-372).-The production of neutrons more rapid than those formerly observed on the disintegration of the U nucleus should occur from energy considerations. The presence of such neutrons when U<sub>3</sub>O<sub>8</sub> was irradiated with neutrons from Ra-Be was detected by means of a He-filled ionisation chamber with a proportional amplifier. Neutrons are also emitted after the irradiation has ceased. The rapid neutrons are emitted immediately from the U. Their energy distribution is similar to that of Ra-Be neutrons, rather than those of the D + D reaction. The no. of neutrons emitted with a half-life of 12 sec. is <0.125 of the no. of observed rapid neutrons for energies > 1.4 Me.v., and < 1/15 for energies >2.4 Me.v. As no protons are emitted it is probable that the process is an independent "evaporation" of neutrons after the disintegration.

A. J. M.

Uranium fission fragments. (A) Energy distribution. (B) Range distribution. E. T. BOOTH and J. R. DUNNING (Physical Rev., 1939, [ii], 55, 981, 982, 1273; cf. A., 1939, I, 235).—(A) An ionisation chamber filled with A and containing a high-voltage electrode of  $U_3O_8$  electrically deposited on Au was exposed to neutrons from a cyclotron, and the ionisation pulses for the uncollimated and collimated chamber were recorded by an amplifier oscillographic system. Ionisation curves show that the fission fragments are divided into at least two major energy groups, the max. energies in each group being  $\sim 100$  and 72 Me.v. The total energy for a single fission is  $\sim 175$  Me.v. (a low val. probably due to excitation of the fragments), and the ratio of the masses of the two fragments  $\sim 96/140$ . With the collimated chamber the fragments are divided into approx. equal major groups.

(B) [With F. G. SLACK.] Using a differential ion chamber and a source deposit of  $U_3O_8$  of 1 mm. air equiv., the range curve for collimated fission fragments shows two major groups of approx. equal intensity and with ranges  $2 \cdot 2 \pm 0 \cdot 1$  and  $1 \cdot 5$  cm., respectively.

N. M. B. Fission products from uranium. G. N. GLASOE and J. STEIGMAN (Physical Rev., 1939, [ii], 55, 982-983).-U<sub>3</sub>O<sub>8</sub> was irradiated with slow neutrons and the products were collected in Cellophane. Decay curves indicate periods of ~9 hr., 80, 32, 17, and 10 min. On elimination of a group of fission products of 1.5 cm. range by Cellophane of 1.4 cm. air equiv., the products passing through this foil showed periods of ~6 hr., 35, 17, and 3 min. Gaseous products were removed and collected by passing  $N_2^{+}$  for selective periods through irradiated U in solution. Results indicate gaseous products of periods 35 sec. and 5 min. associated with Ba (86 min.) and Rb (17 min.), respectively. The longer-range fission products are probably due to Kr-Rb-Sr rather than to Xe-Cs-Ba series. N. M. B.

Retardation in air of atomic fragments resulting from the explosion of uranium nuclei. G. BECK and P. HAVAS (Compt. rend., 1939, 208, 1643—1645).—Theoretical. The neutralisation of the charges on the nuclei produced by rupture occurs by electron capture from mols. in the atm., involving the Auger effect. A. J. E. W.

**Transmutation of thorium by neutrons.** A. H. W. ATEN, jun., C. J. BAKKER, and F. A. HEYN (Nature, 1939, **143**, 679).—The passage of a fast stream of  $N_2$ through a conc. solution of Th(NO<sub>3</sub>)<sub>4</sub> containing a fast neutron source (Li + D), drying (P<sub>2</sub>O<sub>5</sub>), passage over active C immersed in liquid N<sub>2</sub>, and extraction of the radioelements from the C with H<sub>2</sub>O containing Cs<sup>•</sup>, Rb<sup>•</sup>, Ba<sup>••</sup>, Sr<sup>••</sup>, and La<sup>•••</sup>, and suitable pptns. give the same periods for Rb, Ba, and Cs as found in the case of U (A., 1939, I, 234). Sr was inactive. The fission of U and Th thus leads to the same radioactive noble gases. L. S. T.

Adaptation of a small cloud chamber to the study of electron showers. J. E. THOMAS, jun., and W. E. RAMSEY (J. Franklin Inst., 1939, 227, 789— 799).—A shower-producing Pb plate in the chamber described is provided with three counters immediately beneath it and a large no. of narrow counters are placed beneath the chamber. The simultaneous discharge of at least one of the former and any two of the latter automatically actuates the expansion mechanism and photographs the tracks of the incident ray and the shower from opposite directions normal to the plate. L. J. J.

C C\* (A., I.)

Disintegration of nuclei by cosmic rays. A. P. SHDANOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 731-735).—Photographic plates exposed at a height of 9000 m. show a greater frequency of nuclear disintegration than at sea level. A considerable proportion of 4- or 5-branched tracks is found, including a new type in which the five branches are coplanar; of the five, two are attributed to barytrons and three to protons. Showers of five or six particles, showing the action of protons and barytrons, are found, as at sea level; the no. of barytrons appears generally to be even. There is no evidence of increase in the no. of single tracks with height, or of swarms of particles. L. J. J.

Recent advances in the investigation of cosmic rays. T. H. JOHNSON (J. Washington Acad. Sci., 1939, 29, 233—256).

Magnitude distribution of ultraradiation impacts through 10 cm. of iron. A. SITTKUS (Z. Physik, 1939, 112, 626–628).—Observations, extending over 9½ months, of impacts from cosmic rays filtered through 10 cm. of Fe show that the impact distribution curve has the form  $N = N_0 \times a^{-1.82}$ where N = frequency and a = magnitude of the impacts, L. G. G.

Rossi transition curve for small-angle showers. W. M. NIELSEN, J. E. MORGAN, and K. Z. MORGAN (Physical Rev., 1939, [ii], 55, 995—997; cf. A., 1937, I, 595).—Measurements of 7° and 28° cosmic-ray shower production in Fe of thicknesses up to  $\sim 320$  g. per sq. cm. indicate that there is no significant difference in the ratio of counting rates at the first max. of the Rossi transition curve to that under 200 g. per sq. cm. for either large- or small-angle showers, and that the processes responsible for the character of the transition curve under large thicknesses of material are not necessarily restricted to small angles. N. M. B.

Decrease of intensity of cosmic rays in the earth down to 1380 m. water equivalent. J. CLAY and A. v. GEMERT (Physica, 1939, 6, 497-510).-Data are recorded for threefold coincidences under varying thicknesses of clay and slate down to 1380 m. H<sub>2</sub>O equiv., with varying thicknesses of Pb between the counters, and compared with results under H<sub>2</sub>O (A., 1939, I, 175). The decrease depends on the electron density of the material. The primary rays still ionise down to 427 m. H<sub>2</sub>O, so that coincidences at great depths are not due to neutrinos. The no. of secondaries and showers increases from 200 m. to 427 m. H<sub>2</sub>O and then diminishes at greater depths. It is concluded that for  $\sim 5 \times 10^{10}$  ev. the radiation of mesotrons increases, whilst rays penetrating below 427 m. H<sub>2</sub>O are probably protons, the decrease being  $\infty$   $h^{-2\cdot 92}$ . L. J. J.

Latitude effect of cosmic rays in the stratosphere. S. N. VERNOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 738—740).—The intensity of cosmic rays depends markedly on the latitude, indicating that electrically charged particles are concerned. Atm. absorption of cosmic rays deflected by the terrestrial magnetic field is in agreement with Bhabha and Heitler's cascade theory. The intensityaltitude curve in equatorial regions shows a max. inconsistent with the presence of secondary  $\gamma$ -rays with >12% of the total cosmic ray intensity; hence before entering the terrestrial magnetic field the penetrating power of the rays is <7 cm. H<sub>2</sub>O.

Extent and penetrating power of large cosmicray showers. P. AUGER, R. MAZE, and ROBLEY (Compt. rend., 1939, 208, 1641—1643),—The area affected by the showers is studied, using coincidence counters separated by varying horizontal distances (d). The no. of coincidences for large d vals. (20— 300 m.) is  $\gg$  that predicted by Euler's theory, probably owing to production of penetrating particles (mesotrons ?) in the showers. Approx. 10% of the showers give coincidences through 15—20-cm. Pb screens, and evidently contain mesotrons or groups of high-energy electrons. A. J. E. W.

Secondary radiation produced by the penetrating component of cosmic rays. G. C. FRANK-KAMENETZKI (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 742—743).—The intensity of the secondary radiation, determined by the Rossi-Auger method, is  $4.5\pm3\%$  that of the penetrating component in Pb,  $11\pm3\%$  in Al, and  $33\pm3\%$  in air, in contrast to the theoretical increase with at. no. for secondary  $\delta$ -radiation. A considerable proportion of the soft component at sea level consists of secondary radiation. L. J. J.

Releasing radiation for hard showers. K. SCHMEISER (Z. Physik, 1939, 112, 501-511).--Counter tubes are so arranged above and below a Pb secondary radiator as to record, by multiple coincidence, showers produced from ionising and nonionising radiation respectively. For Pb 1.5 cm. thick soft showers are produced chiefly from ionising particles and hard showers chiefly through photons. Hard showers from Pb 15 cm. thick are mainly due to the action of charged mesotrons and in part also to an uncharged radiation which probably consists of neutral mesotrons. L. G. G.

Cosmic-ray burst of a hundred particles. A. JDANOFF [SHDANOV] (Nature, 1939, 143, 682).— Stereoscopic photomicrographs showing a cosmic-ray burst of ~100 heavy particles on a photographic plate with thick emulsion exposed to the action of the rays are reproduced and analysed. Assuming that the particles are protons, the total energy of the burst is  $\neq$  200 Me.v. The no. of disintegrations and heavy particles per disintegration increases rapidly with increasing altitude from sea level to 9000 m. L. S. T.

Cloud chamber studies of cosmic-ray showers and penetrating particles. J. C. STREET (J. Franklin Inst., 1939, 227, 765—788).—The statistical distribution of showers produced by successive layers of Pb of different thicknesses indicates that showers are not formed if the thickness is small compared with the free paths for radiation and pair formation according to the multiplicative theory, and that explosion showers are very rare. Examination of the rangeenergy relation of the penetrating particles shows considerable straggling, and supports the view that they are barytrons with mean energy ~1350 Me.v.

L. J. J.

Origin of slow mesotrons. H. MAIER-LEIBNITZ (Forsch. u. Fortschr., 1939, 15, 221–222).—Using a "slow" Wilson cloud chamber, five mesotrons have been photographed and the mass of each deduced. The mass appears to vary. The penetrating properties and probable origins of hard and of weak mesotron components of cosmic radiation are discussed. W. R. A.

Mass and mean life-time of the meson. H. YUKAWA and S. SAKATA (Nature, 1939, 143, 761— 762).—The mean life-time of the mesotron increases rapidly with a decrease in mass, but the theoretical val. is always < the experimental val. of  $2 \sim 4 \times 10^{-6}$ sec. found from cosmic-ray data. L. S. T.

Non-ionising particles in the penetrating component of cosmic radiation. V. I. VEKSLER (Compt. rend. Acad. Sci. U.R.S.S., 1939, 22, 308—311; cf. A., 1939, I, 174).—A discussion based on Rossi's shower curves and the absorption curves of cosmic radiation leads to the probability, though not to the certainty, that there are neutral particles of high penetration in cosmic radiation. T. H. G.

Materialisation of energy. A. M. DA SILVA (Ann. Physique, 1939, [xi], **11**, 504—547).—The measurements of Skobelzyn and Stepanova (A., 1935, 425) on the effective section of materialisation of the kinetic energy of  $\beta$ -rays of Ra-*C* and its proportionality to the first power of *Z* of the bombarded element have been confirmed. Attempts by other investigators to prove this have been vitiated principally by faulty technique. The materialisation of a photon in the field of an electron has been observed in agreement with the theoretical predictions of Perrin.

W. R. A.

Molecular spectra of hydrogen isotopes. I. Application of the rotating vibrator model to the states of  $D_2$ . I. SANDEMAN (Proc. Roy. Soc. Edin., 1939, 59, 1—14).—Theoretical. L. J. J.

Mass of elementary particles. A. PROCA and S. GOUDSMIT (J. Phys. Radium, 1939, [vii], 10, 209-214).—A detailed account of work already noted (A., 1939, I, 297). W. R. A.

Ionic radius and the periodic system. E. KORDES (Z. physikal. Chem., 1939, 43, B, 213— 228).—Empirical relations between the ionic radius, at. no., and the Born repulsion exponent have been used to calculate the ionic radii of the elements. Reasonable agreement was obtained with theoretical and empirical vals. of other investigators. C. R. H.

Shape and stability of heavy nuclei. G. YOUNG (Physical Rev., 1939, [ii], 55, 1102—1103).—Feenberg's stability criterion (cf. A., 1939, I, 237) is shown to be a special case of more general equations encountered in the biophysical theory of cell division.

N. M. B. Theory of nuclear structure. E. U. CONDON (J. Franklin Inst., 1939, 227, 801–816).—A survey of current nuclear theory. L. J. J.

Liquid-drop model and nuclear moments. (MISS) K. WAY (Physical Rev., 1939, [ii], 55, 963– 965).—A comparison of magnetic and electric quadrupole moments of charged spinning drops with

L. J. J.

experimental nuclear moments shows very poor agreement. N. M. B.

Non-euclidean geometry in microscopic space. J. MARIANI (Nature, 1939, 143, 683).—Theoretical. L. S. T.

Duality principle and representation of elementary corpuscles. J. MARIANI (Compt. rend., 1939, 208, 1630-1632).-Mathematical.

A. J. E. W.

Angle dependence and range of nuclear forces. D. R. INGLIS (Physical Rev., 1939, [ii], 55, 988).— Mathematical. N. M. B.

Fatigue phenomena of electron-irradiated luminous substances. W. GROTHEER (Z. Physik, 1939, 112, 541—559).—The substances to be examined are supported on the screen of a modified cathode-ray tube, and the intensity of the emitted light is determined with a photo-electric cell. The intensity of light emission during irradiation with electrons decays approx. exponentially, reaching a finite val. >0, due to a simultaneous regeneration effect. A theoretical explanation of the phenomena is given.

Light intensity of a black body at the temperature of solidifying platinum. H. WILLENBERG (Physikal. Z., 1939, 40, 389–394).—The new unit of light intensity to be introduced from Jan. 1, 1940, is defined as follows : the light intensity of a black body at the f.p. of pure Pt ( $2047^{\circ}$  K.) is 60 new units per sq. cm. The calibration of photometer lamps intended for international comparison determinations with the new units is described. A. J. M.

Band spectrum of HS. (MISS) N. LEWIS and J. U. WHITE (Physical Rev., 1939, [ii], 55, 894—898).— The absorption spectrum of HS was obtained by passing repeated flashes from a source of continuous background through a discharge tube in which HS radicals are formed from H<sub>2</sub>S by pulses of radiofrequency current synchronised immediately to precede the flashes. The spectrograms show one  ${}^{2}\Sigma \rightarrow \Pi$  band at 3237 A. Data are tabulated, structure and analysis are discussed, and consts. are evaluated.

N. M. B.

Explanation of the intensity distribution in the spectrum of aluminium hydride. G. STEN-VINKEL (Naturwiss, 1939, 27, 370).—Schüler *et al.* (A., 1939, I, 177), from experiments with the spectrum of AlH excited in a discharge using a hollow cathode cooled in liquid air, conclude that AlH is not formed in the gas space. This is not confirmed by experiments with the King oven, and an alternative explanation of the intensity distribution in the spectrum of AlH is proposed. A. J. M.

Electronic spectrum of selenium dibromide vapour. M. WEHRLI (Helv. Phys. Acta, 1936, 9, 329-330; Chem. Zentr., 1936, ii, 3982).—The spectrum has been studied by heating Se<sub>2</sub>Br<sub>2</sub> in an absorption tube allowing independent variation of the temp. of the tube  $(\theta_t)$  and the substance  $(\theta_s)$ . Diffuse absorption bands in the greenish-blue region  $(\theta_t \ 170^\circ, \theta_s \ 165^\circ)$  are attributed to SeBr<sub>2</sub> by analogy with TeBr<sub>2</sub>. The bands form a fluctuation spectrum or a discrete system with strong predissociation of the excited state. A continuum, spreading from short to long  $\lambda\lambda$ , appears on raising  $\theta_s$  or  $\theta_t$ . The higher vibrational levels of the ground state are the most fully occupied. Thermal dissociation is not detected at 415°. The reaction  $2\text{SeBr}_2 = \text{Se}_2\text{Br}_2 + \text{Br}_2$  probably occurs on condensation. A. J. E. W.

Absorption spectra of permanganate, chromate, vanadate, and manganate ions in crystals. J. TELTOW (Z. physikal. Chem., 1939, 43, B, 198– 212).—Absorption in the visible and ultra-violet regions at  $-253^{\circ}$  has been examined for mixed crystals of KMnO<sub>4</sub>-KCIO<sub>4</sub>, K<sub>2</sub>CrO<sub>4</sub>-K<sub>2</sub>SO<sub>4</sub>, Na<sub>3</sub>VO<sub>4</sub>-Na<sub>3</sub>PO<sub>4</sub>, and K<sub>2</sub>MnO<sub>4</sub>-K<sub>2</sub>SO<sub>4</sub>. The data are discussed from the viewpoint of chemical union.

C. R. H. Isotope effect in the line absorption spectrum of uranyl nitrate. G. Joos and B. DUHM (Nachr. Ges. Wiss. Göttingen, Math.-phys. Kl., II, 1936, 2, 123—126; Chem. Zentr., 1936, ii, 4094).—The absorption lines of  $UO_2(NO_3)_2,6H_2O$  (at 20—83° K.) are displaced ~2 A. towards shorter  $\lambda\lambda$  on replacement of the H<sub>2</sub>O by D<sub>2</sub>O. The v differences of homologous lines due to  $UO_2$ " remain const. Lines with smaller v vals. (due to  $UO_2$ " associated with H<sub>2</sub>O or D<sub>2</sub>O mols.) are displaced further. A rise of temp. causes similar displacements, as an increase in the intensity of the field around the excited electron may be caused by a temp. rise, or by a decrease in the zero-point energy due to introduction of D.

A. J. E. W.

Constitution of mercurithiocyanates. F. GAL-LAIS (J. Chim. phys., 1939, 36, 99—101; cf. A., 1938, I, 558).—To account for the abnormally high hight absorption and magnetic rotatory power of mercurithiocyanates as compared with mercuricyanides, it is suggested that isomerisation of CNS occurs during their formation in aq. solution. Comparison of the absorption and magnetic rotation of EtSCN with those of EtNCS shows considerably higher vals. for the latter and thus supports the view that the complexes in question should be represented as mercurisothiocyanates. F. L. U.

Ozonisation of allyl-, propenyl-, and a-methylvinyl-benzene. Results of physico-chemical determinations (Raman spectra, ultra-violet absorption spectra, dielectric constants, and dipole moments). E. BRINER, K. RYFFEL, and E. PERROTTET (Helv. Chim. Acta, 1939, 22, 927-934).-The quant. ozonisation of allyl- (I), propenyl-(II), and  $\alpha$ -methylvinyl- (III) -benzene has been studied. The ozonide (IV) of (I) is sufficiently stable to permit its isolation and the measurement of its physical consts. In the Raman spectra of the three isomeric hydrocarbons the frequency of the double linking increases in the sequence (II), (I), (III) as observed previously in other series. In the Raman spectrum of (IV) there is no frequency for a double linking, but other new frequencies appear. The addition of  $O_3$  to the mol. of (I) causes a shift of the absorption band (~400 A.) towards longer  $\lambda\lambda$ . The dipole moments of (I), (II) and (III) are almost the same. The dielectric const. of (IV) increases with the time as observed with other ozonides. The dipole moment of (IV) somewhat exceeds that of (I) but the

L. G. G.

relatively small increase shows that the electric symmetry is little altered by the addition of 3 O to the hydrocarbon mol. H. W.

Ultra-violet absorption spectra of salicylic acid and lithium salicylate vapours. C. S. PIAW (Compt. rend., 1939, 208, 1563—1565).—The vapours (at 130—220°) give absorption max. at  $\sim 3050$  A. (A-region), 2385, 2349, and 2317 A. (B-region), and continua at < 2250 A. These data confirm that the B-bands, which also occur with the aq. acid (I) (cf. A., 1939, I, 354), are due to the undissociated mols., and that the A-bands given by (I) at  $\sim 2960$  and 3006 A. are due to ionised, and to ionised and neutral, mols., respectively. The three B-bands do not belong to a single electronic system, but give two vibrational w (642, 555 cm.<sup>-1</sup>), which are attributed to normal and electronically excited states, respectively. A. J. E. W.

Optical properties and structure of cyanocamphor. J. P. MATHIEU and M. RONAYETTE (Compt. rend., 1939, 208, 1567-1569).-The absorption coeff. (k), circular dichroism ( $[\Delta]$ ), and  $[\alpha]$  for cyanocamphor (I) in a no. of solvents, at 2500-6000 A., are studied. The C:O absorption band has a broad max. at 2900 A. The variation of  $[\Delta]$  in this region is complex, and the  $[\Delta]/\lambda$  curve is resolvable into three curves of the Lowry-Hudson type, which (except at low  $\lambda\lambda$ ) satisfactorily account for the observed variation of  $[\alpha]$  with  $\lambda$ . The solutions exhibit mutarotation, which is accelerated by a rise in temp. or the presence of H<sub>2</sub>O or bases; the mutarotation is not due to keto-enolic isomerism or to the formation of a structure such as  $C_8H_{14} < CO$ , as the intensity of the C:O band remains const. The

Na derivative probably has a structure of the above type (cf. A., 1905, i, 112), solutions of (I) in NaOH giving much higher vals. of k. The mutarotation is probably caused by interchange of the H and CN associated with the CO group. A. J. E. W.

Absorption spectra of the compounds formed by androsterone and testosterone in the mdinitrobenzene reaction.—See A., 1939, II, 378.

Absorption spectra of some naturally-occurring naphthaquinones and their derivatives. R. G. COOKE, A. K. MACBETH, and F. L. WINZOR (J.C.S., 1939, 878-884).-The absorption spectra of lapachol and lomatiol agree with that of phthiocol (A., 1937, II, 460) as anticipated, and their derivatives of 1:4- (I) and 1:2-naphthaquinone (II) structure show max. characteristic of  $\alpha$ - and  $\beta$ -naphthaquinones. The absorption curve of dunnione confirms the (II) structure suggested by Price and Robinson (A., 1938, II, 375) and is almost identical with that of dehydroiso- $\beta$ -lapachone.  $\alpha$ - and  $\beta$ -unsaturation in the side-chain of (I) and (II) results in the appearance of an inflexion in the absorption spectra instead of the band at  $\sim$ 3330 A. characteristic of the C:O group in the system C:C·C:O, and in the displacement of the long- $\lambda$ bands to greater  $\lambda\lambda$ . The absorption spectrum of dehydrolapachone favours the β-quinonoid structure. The prep. of lapachol acetate, m.p. 65-66°, and lapachol Me ether, m.p. 53°, is described. W. R. A.

Absorption spectra of single crystals of hæmoglobin in polarised light.—See A., 1939, III, 785.

Oscillation frequencies of nitrates. D. WILLIAMS and L. DECHERD (J. Amer. Chem. Soc., 1939, 61, 1382—1384).—The infra-red absorption spectra of aq. LiNO<sub>3</sub>, NaNO<sub>3</sub>, and KNO<sub>3</sub> have been studied in cells with thin fluorite windows between 6 and 16  $\mu$ . and are compared with existing infra-red and Raman data for solutions and cryst. solids. W. R. A.

Infra-red plecchroism and Fermi resonance associated with  $CH_2$  groups in crystals. J. W. ELLIS and (MISS) J. BATH (Physical Rev., 1939, [ii], 55, 1098—1099).—The absorption bands near 1-7  $\mu$ ., including the first harmonics of the C–H valency vibrations, and the pleochroism displayed by the dependence of these bands on the azimuth of vibration of the electric vector of the light are discussed for crystals of C(CH<sub>2</sub>·OH)<sub>4</sub> and diketopiperazine.

N. M. B. Structure of ethylene. H. W. THOMPSON (Trans. Faraday Soc., 1939, 35, 697—701; cf. A., 1937, I, 500).—Detailed analysis of the absorption bands with centres ~9875 and 9714 A. leads to vals. of moments of inertia of the mol. which agree very closely with those derived from independent data. Vals. of mol. dimensions finally adopted are :  $r_{\rm CH} =$ 1.085,  $r_{\rm cc} = 1.331$  A.; angle HCH = 118°. F. L. U.

Infra-red bands and association of some hydroxylic compounds. H. W. THOMPSON (J. Amer. Chem. Soc., 1939, 61, 1396-1400).-The O-H absorption between 8000 and 10,000 A. has been investigated for OH·[CH2]2·CN (I) (liquid at 4 temp. between 25° and 150°),  $OH \cdot [CH_2]_3 \cdot CN$  (II) (liquid at 25° and 150°),  $OH \cdot [CH_2]_2 \cdot SH$  (III) (liquid at 25° and 90°; also in  $CCl_4$  solution),  $OH \cdot [CH_2]_2 \cdot NH_2$  (IV) (liquid at 25° and 100°; vapour), and OH CMe2 CN (V) (liquid at  $25^{\circ}$  and  $100^{\circ}$ ; vapour at  $\sim 1$  atm.). (I), (II), (III), and (V) give spectra similar to that of EtOH, and indicate extra-mol. association. Rise of temp. causes increased intensity of the band at 9650 A. due to dissociation of the associated mol. There are also bands at  $\sim 9050$  A. due principally to  $4v_{CH}$  but with apparently some superposed band connected with association. The spectrum of the vapour of (V) is complicated by the absorption by decomp. products of (V) in the region studied. (IV) gives a particularly complicated spectrum. W. R. A.

Infra-red absorption spectra of acetaldehyde, paraldehyde,  $\alpha$ - and  $\beta$ -trithioacetaldehyde. H. GERDING and J. LECOMTE (Rec. trav. chim., 1939, 58, 614-637).—The infra-red absorption spectra of gaseous and liquid MeCHO (7-14  $\mu$ .), liquid paraldehyde (I) (7-20  $\mu$ .), solid  $\alpha$ - and  $\beta$ -trithioacetaldehyde (II) (7-14  $\mu$ .), and their solutions in CS<sub>2</sub> (7-20  $\mu$ .) have been determined. The findings are correlated with the Raman spectra (cf. A., 1939, I, 403) and the assignment of frequencies is discussed. The molof (I) is not plane, and there is probably inner equilibrium in the liquid between *cis*- and *trans*-forms. (II) also has a non-planar configuration and the  $\beta$ -form has the *cis*-configuration. F. J. G. Infra-red absorption spectra of monosubstituted naphthalene derivatives. J. LECOMTE (Compt. rend., 1939, 208, 1636—1638).—The infrared absorption spectra of  $\alpha$ - and  $\beta$ -C<sub>10</sub>H<sub>7</sub>X [X = OH, NH<sub>2</sub>, Me, CN ( $\beta$ ), Cl, Br, I, and NO<sub>2</sub> ( $\alpha$ )] have been studied in the region 500 to 1200 cm.<sup>-1</sup> The results, supplemented by Raman data, confirm that the mols. have a plane of symmetry, and provide a scheme of vibrational w for the monosubstituted compounds. The paucity of Raman lines is probably due to the occurrence of numerous oblique vibrations which, although not forbidden in scattering, do not give Raman w. The w of C<sub>10</sub>H<sub>8</sub> occur, slightly displaced, with C<sub>10</sub>H<sub>7</sub>X, showing the predominant effect of the aromatic nucleus. The  $\alpha$ -linking w occur at 638—700 cm.<sup>-1</sup>; the  $\beta$ -linking v in C<sub>10</sub>H<sub>8</sub> is possibly 961 cm.<sup>-1</sup> A. J. E. W.

Depolarisation measurements on Raman lines by an easy, accurate method. F. F. CLEVELAND and M. J. MURRAY (J. Chem. Physics, 1939, 7, 396-400).-Depolarisation factors (p) of Raman lines are measured by interposing, between the Raman tube and the lens condensing scattered light on the spectrograph slit, a Polaroid disc oriented in such a way that it passes light which has its electric vector horizontal. Two exposures of equal duration are taken, one with the arc below the Raman tube and the other with the arc at the side of the tube. The ratio of the two intensities  $(\rho)$  is obtained by comparison with lines in a series of spectra of A, intensity range 1:7. Advantages over other methods and data for  $CCl_4$  and  $C_6H_6$  are discussed. W. R. A.

Raman spectrum and structure of chloric, bromic, and iodic acids. R. FONTEYNE (Natuurwetensch. Tijds., 1939, 21, 141—144).—Raman spectra of HClO<sub>3</sub> and HBrO<sub>3</sub> solutions show that they contain only ClO<sub>3</sub>' and BrO<sub>3</sub>' of symmetry  $C_{3v}$ . The valency force and the angle formed by the sides of the pyramid and the perpendicular to the base are smaller than for the ions from the Na salts. Solutions of HIO<sub>3</sub> contain IO<sub>3</sub>' of symmetry  $C_{3v}$ , and the pseudo-acid HO·IO<sub>2</sub>. Very conc. solutions also contain I<sub>2</sub>O<sub>6</sub>''. S. C.

Lattice oscillations in crystals. (SIR) C. V. RAMAN and T. M. K. NEDUNGADI (Nature, 1939, 143, 679).—Photographs of the spectra of the 4358 A. Hg arc line scattered by a NaNO<sub>3</sub> crystal set successively in 3 mutually perpendicular directions to the incident polarised light show that when the optic axis of the crystal is parallel to the direction of observation the lattice lines disappear. Other lines ascribed to the internal oscillations of NO<sub>3</sub>' appear strongly in this position, and also in one of the positions perpendicular to it, but are weak in the third position when the incident light-vector is along the optic axis of the crystal and the polarisability of NO<sub>3</sub>' is a min.

L. S. T.

Raman effect. C. Esters of boric acid. L. KAHOVEC (Z. physikal. Chem., 1939, 43, B, 109– 118).—Data for the esters of boric acid,  $B(OX)_3$ (X = Me, Et, Bu<sup>a</sup>, Bu<sup>β</sup>, sec.-Bu, Bu<sup>γ</sup>, Ac), are recorded and discussed. From  $B(OAc)_3$  and the appropriate alcohol sec.-, b.p.  $83 \cdot 5 - 84 \cdot 5^{\circ}/13$  mm.,  $185^{\circ}/760$  mm. (decomp.), and tert.-Bu borate, b.p.  $59 \cdot 5 - 60 \cdot 5^{\circ}/12$  Molecular complexes in chloroform solution. G. V. L. N. MURTI and T. R. SESHADRI (Current Sci., 1939, 8, 209).—Unsaturated carbonyl compounds in CHCl<sub>3</sub> show a shift of the Raman line for the CO: group to lower frequencies, attributed to H bonding. S. H. H.

Effect of temperature on the characters of the wings accompanying the Rayleigh lines in liquids. K. BAPAYYA (Proc. Indian Acad. Sci., 1939, 9, A, 404-409).—The depolarisation of the continuous wing exhibited by  $C_6H_6$  and  $CHCl_3$  has a limiting val. of 0.86 at all places and does not alter with temp. The depolarisation factor for the total scattering in  $C_6H_6$  falls from 0.44 at 30° to 0.11 at 260°. W. R. A.

Raman effect. CI. Iodine derivatives X·CH<sub>2</sub>I. W. BACHER and J. WAGNER (Z. physikal. Chem., 1939, 43, B, 191-197).—Data for CH<sub>2</sub>CII, CH<sub>2</sub>BrI, CH<sub>2</sub>I<sub>2</sub>, CH<sub>2</sub>PhI, CH<sub>2</sub>:CH·CH<sub>2</sub>I, and CH<sub>2</sub>CIBr are recorded. C. R. H.

Raman effect. XCVII. Poly-substituted benzene. (XII). para-Derivatives. O. PAULSEN. XCVIII. (XIII). Analysis of "para" spectra. K. W. F. KOHLRAUSCH and O. PAULSEN (Monatsh., 1939, 72, 244—267, 268—289).—XCVII. Raman w, intensities, and in most cases depolarisation factors, of PhOMe and of the following p-substituted C<sub>6</sub>H<sub>6</sub> derivatives are recorded : C<sub>6</sub>H<sub>4</sub>ClBr, C<sub>6</sub>H<sub>4</sub>X<sub>2</sub> (X = OMe, OH, Cl, I), NH<sub>2</sub>·C<sub>6</sub>H<sub>4</sub>·X (X = OH, Cl, I, NH<sub>2</sub>), C<sub>6</sub>H<sub>4</sub>MeX (X = OH, F, Cl, Br, I, NH<sub>2</sub>; Me, OMe), OMe·C<sub>6</sub>H<sub>4</sub>·X (X = NH<sub>2</sub>, OH, F, Cl, Br, I). The influence of substituent groups on the val. of characteristic vv of PhMe and PhOMe, and on the vals. of the inner vv of Me and OMe, is considered.

XCVIII. A collation of data on *p*-substituted derivatives of  $C_6H_6$ . Observed w of  $C_6H_6$  and  $C_6H_4X_2$  (X = Me, Cl, Br) are compared with vals. deduced from mechanical models. Symmetry properties of  $C_6H_6$ , p- $C_6H_4X_2$ , and p- $C_6H_4XY$  are considered. The influence of X and Y on the CH deformation frequency at ~1176 cm.<sup>-1</sup> and the frequency shifts arising from the transformations,  $C_6H_6 \rightarrow C_6H_4X_2 \rightarrow$  $C_6H_4$  and  $C_6H_6 \rightarrow C_6H_4XY \rightarrow C_6H_4$ , are discussed. W. R. A.

Raman spectra of acetaldehyde and paraldehyde. H. GERDING and G. W. A. RIJNDERS (Rec. trav. chim., 1939, 58, 603-608).—The findings agree in the main with those of other workers (A., 1934, 473; 1937, I, 220, 345). Minor divergences are discussed. Rise of temp. from 15° to 59° has no influence on the Raman spectrum of paraldehyde. F. J. G.

Raman spectra of  $\alpha$ - and  $\beta$ -trithioacetaldehyde and of monothioparaldehyde. H. GERDING and J. G. A. KARSTEN (Rec. trav. chim., 1939, 58, 609— 613).—The Raman spectra of the three substances in solution in CCl<sub>4</sub> have been determined. The  $\alpha$ -form of C<sub>6</sub>H<sub>12</sub>S<sub>3</sub> has the lower symmetry and is therefore the *trans*-form, as suggested on chemical grounds by Chattaway and Kellett (A, 1930, 1022). F. J. G.

II(a-c)

Luminescence of adhesive tape [and other substances]. E. N. HARVEY (Science, 1939, 89, 460—461).—The greenish luminescence which occurs when adhesive tape is stripped from a roll is due to an electrical discharge, for in Ne a reddish luminescence is obtained. Allied phenomena shown by a large no. of substances, including discharges from triboor piezo-electricity, are described. Collodion films are the most striking luminescent bodies. A. E. M.

Chromoisomerism of diphenylamine derivatives.—See A., 1939, II, 363.

Influence of the electric field on the form of electro-photo-luminescence emission bands. G. DESTRIAU and G. LOUDETTE (Compt. rend., 1939, 208, 1569—1571).—The intensity of luminescence induced by high a.c. potentials (cf. A., 1939, I, 126) is given by the expression  $I = Ae^{-B/V}$ ; the const. B varies with  $\lambda$ , and the form of the  $\alpha$ -emission band is therefore dependent on the applied potential, V. B falls with increasing  $\lambda$  with ZnS-CdS and ZnS-Mn phosphors, but rises with a ZnS-Cu phosphor. A. J. E. W.

Quenching of fluorescence and photothermal decomposition of aniline. A. T. VARTANIAN (J. Phys. Chem. Russ., 1938, 12, 308-325).-The fluorescence of  $NH_2Ph$  vapour at p = 0.02 mm. Hg at room temp. is quenched by O2 more strongly than by  $NH_3$  or  $H_2$ ; the calc. effective cross-sections of these mols. are 74, 5, and  $0.67 \times 10^{-16}$  sq. cm. respectively. The intensity of the fluorescence of  $NH_2Ph$  at const. p decreases with rising temp. (18- $400^{\circ}$ ; the allowance for the increase of absorption due to the v.d. increasing with temp. is not sufficient to explain it. The absorption per mol. for 2650 and 2800 A. is independent of temp. Heating of NH,Ph to 400° in vac. has no effect but heating and irradiation in a quartz vessel produce new substances which apparently include  $H_2$ ,  $NH_3$ , and  $N_2H_4$  in addition to a fluorescent and a solid substance. J. J. B.

Fluorescence and absorption measurements on benzene derivatives, particularly condensed systems. H. LEY and H. SPECKER (Z. wiss. Phot., 1939, 38, 13–27).—Fluorescence and absorption spectra of  $C_6H_6$ ,  $CH_2Ph_2$ ,  $(CH_2Ph)_2$ ,  $(CHPh)_2$ ,  $\alpha$ methylstilbene,  $(:CPh_2)_2$ ,  $(CH_2Ph \cdot CH:)_2$ , NHPh<sub>2</sub>, Ph<sub>2</sub>O, Ph<sub>2</sub>S, PhOH, PhSH, fluorene, diphenylene oxide and sulphide, carbazole, and Ph<sub>2</sub> are given.

W. R. A.

[Factors] influencing the luminescence of lucigenin [dimethyldiacridylium nitrate]. O. SCHALES (Ber., 1939, 72, [B], 1155—1160).—The luminescence of lucigenin (I) due to reaction with  $H_2O_2$  occurs in alkaline solution only, and becomes undetectable below  $p_{\rm H}$  9.08. It is most intense with 0.375N-NaOH, and the half-life period decreases with increasing [NaOH] between 0.125 and 2.5N. (I) can be used to detect 1 in 100,000 of  $H_2O_2$ , but is much less sensitive for this purpose than luminol (3-aminophthalhydrazide) (cf. A., 1939, I, 151). Hitherto only OsO<sub>4</sub> has been found to catalyse the luminescence of (I) with  $H_2O_2$ . F. L. U.

Semi-conductors in intense fields and their rectifying action. A. F. JOFFE (Bull. Acad. Sci., U.R.S.S., 1938, Sér. Phys., 617-624). L. J. J. Theory of rectification in semi-conductors. B. J. DAVIDOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 625-630).—The concess of free charge near the junction of two semi-conductors having different types of conductivity is influenced by passage of a current through the junction. This produces an additional resistance dependent on the direction of the current. L. J. J.

Semi-conductors in strong electric fields. N. L. PISARENKO (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 631-640).—Increased concn. of free electrons in semi-conductors may be produced by an intense electric field by ionisation of atoms of impurities or of the semi-conductor, either through the tunnel effect, or through a decrease in electron bond energy produced by the field, or by collision with neutral atoms of conductivity electrons accelerated by the field. L. J. J.

High-voltage polarisation in cuprous oxide and selenium at low temperatures. V. I. LJASCHENKO and G. A. FEDORUS (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 641-650).—Nasledov and Nemenov's observation (cf. A., 1935, 1303) of potential jumps at the electrodes at low temp. independent of the direction of the field is confirmed for Cu<sub>2</sub>O and Se, and in addition a high-voltage polarisation causing a potential jump which depends on the direction of the field is recorded. L. J. J.

Internal photo-electric effect. P. S. TARTA-KOVSKI (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 689—694).—Alkali halide crystals, either unactivated or containing U-centres, show an internal photoelectric effect and fluorescence in the ultra-violet, analogous to those found in the presence of F-centres. The photo-electrons leave the conductivity zone at the end of their path, and reach the F' level. L. J. J.

Thallium sulphide photo-cells with "positive" photo-effects in the blocking layer. B. T. Kolo-MIETZ (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 695-704).—The sign of the conductivity of semiconducting  $Tl_2S$  determines that of the photo-effect. "Positive" photo-effects are produced by electron transfer from the metal into free energy levels produced by the action of light on the semi-conductor. "Positive" photo-cells have a wide region of spectral sensitivity with a max. at 1  $\mu$ ., and have 65 times the X-ray sensitivity of Se cells. Temp. has a marked effect. L. J. J.

Spectral characteristics of selenium photoelements. E. K. PUTSEIKO (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 713—720).—Admixtures of traces of S and Te cause displacements of the spectral sensitivity curve of Se towards short and long  $\lambda\lambda$ , respectively. L. J. J.

Dielectric properties of fused basalt. A. G. ANSHUR (Trav. Univ. Etat Arménie, 1934, [i], 1, 28— 33; Chem. Zentr., 1936, ii, 4194).—The sp. resistance is  $10^{13} \Omega$ .  $\epsilon$  (7—18) varies only slightly with v, and dielectric losses are low. The breakdown voltage is ~70 kv. per cm. Possible applications are discussed. A. J. E. W.

Relations between certain properties of gases and vapours, in connexion with absorption by them of high-frequency electrical fields. E. K. ZAVOJSKI and S. G. SALICHOV (Sci. Mem. Kazan State Univ., 1938, 98, No. 4, 101-114).-Absorption of a high-frequency electrical field by vapours or gases is given by  $Q = \beta T + \alpha$ , where T is the temp.,  $\beta$  is a const., the val. of which depends on the no. of atoms per mol. of the given gas, and  $\alpha$  is a characteristic const. for each gas. An empirical equation connecting dQ/dT with the dipole moment, and its temp. coeff., is given. Identical vals. of  $\beta$  are found for COMe<sub>2</sub>,  $Et_2O$ , EtOAc, EtOH,  $C_6H_6$ , and  $CO_2$ ;  $\beta$  for diat. gases (air, O2, N2) is 1.4 times as great as for the preceding group, whilst for highly asymmetrical mols. (HCl, HBr,  $NH_3$ )  $\beta$  is still higher. R. T.

Conductivity of apolar amorphous substances, in the softening zone. J. J. JANSON (Sci. Mem. Kazan State Univ., 1938, 98, No. 4, 127—147).—The conductivity of paraffin wax rises to a max. at 25°, then falls to a min. at 35°, and again rises sharply at 40°. In the softening zone (40—49°) paraffin behaves similarly to amorphous polar substances. R. T.

Theory of the mercury-vapour lamp. A. J. NIKIFOROV (Sci. Mem. Kazan State Univ., 1938, 98, No. 4, 115—120).—It is shown, on theoretical grounds, that the temp. at the Hg cathode is  $\geq 235^{\circ}$ , whence it follows that maintenance of the arc by thermionic emission of electrons is improbable. R. T.

Dependence of absorption of weak highfrequency electrical fields by certain substances on the tension of these fields. B. M. KOZIREV and S. G. SALICHOV (Sci. Mem. Kazan State Univ., 1938, 98, No. 4, 149—152).—Absorption falls linearly with increasing tension of the field in the case of  $H_2O$ ; with  $C_6H_6$ , PhMe, xylene, EtOAc, and  $H_2C_2O_4$  the curves are discontinuous. R. T.

Dielectric constants of ammonium salts near the lower transition temperature. I. Ammonium chloride and bromide. J. H. BRUCE (Trans. Faraday Soc., 1939, 35, 706—711).—When NH<sub>4</sub>Cl and NH<sub>4</sub>Br are cooled an abrupt fall of  $\epsilon$  occurs at -30.5 and -38°, respectively. Hysteresis is observed on warming. F. L. U.

Dielectric constants of the ammonium halides. R. GUILLIEN (Compt. rend., 1939, 208, 1561—1563). — $\epsilon/\theta$  curves (0° to  $-80^{\circ}$  or to  $-200^{\circ}$ ) are given for the four halides.  $\epsilon$  for NH<sub>4</sub>F decreases slowly on cooling, and increases slightly (0.06%) at the  $\lambda$ -point. NH<sub>4</sub>I gives pronounced max. vals. of the dielectric const.  $\epsilon'$  and the electric absorption  $\epsilon''$  at the  $\lambda$ -point ( $-28.5^{\circ}$ ), and smaller peaks due to the change of cryst. form occur at  $-5.9^{\circ}$ . Powdered NH<sub>4</sub>Cl and NH<sub>4</sub>Br give similar results, a break in the  $\epsilon/\theta$  curve occurring at the  $\lambda$ -point, but  $\epsilon$  increases to a greater extent on transformation into the simple cubic form. Sheets cut from blocks of fibrous NH<sub>4</sub>Cl give a sharper peak at the  $\lambda$ -point on cooling, the difference being due to a false equilibrium between the two states.

A. J. E. W. Dielectric constant, dipole moment, and molecular polarisation of 1 : 4-dioxan. W. C. VAUGHAN (Phil. Mag., 1939, [vii], 27, 669-671).—Vals. of  $\epsilon$  for the range 14—87° are recorded ( $\epsilon_{25^{\circ}} = 2.280$ ); they diminish as the temp. rises. The mol. polarisation is 25.71 and practically independent of temp.;  $\mu = 0$ . The similarity between certain properties of dioxan and  $C_6H_6$  is noted. W. R. A.

Dipole moments of organic molecules containing oxygen. E. A. SCHOTT-LVOVA and J. K. SIRKIN (J. Phys. Chem. Russ., **12**, 479–480).—The dipole moments of various aromatic compounds containing OH, CHO, and OMe are recorded. R. C.

Steric influences on the phenomenon of resonance. II. C. E. INGHAM and G. C. HAMPSON (J.C.S., 1939, 981-986; cf. A., 1937, II, 92).-Previous measurements on the dipole moments of substituted durenes showed that with a branched substituent the steric effects of the Me groups reduced the mesomeric moment, the measured moment lying between the vals. for the corresponding  $C_6H_6$  and alkyl compounds. When the substituent was a single atom, no steric influences were involved and the moment of the durene compound was the same as that of the corresponding  $\dot{C}_6H_6$  derivative. These conclusions have been confirmed by work at 25° on  $C_6H_6$  solutions of mesidine, dimethylmesidine, durenol, nitrodimethylaminodurene, m.p. 90°, nitroethoxydurene, m.p. 75.5°, nitrodurenol, m.p. 123-124°, and 2-nitro-m-5-xylidine (I), m.p. 131.6°. A comparison of the moment of (I), in which only the NO<sub>2</sub> is blocked by Me groups, with those of p-NO<sub>2</sub>·C<sub>6</sub>H<sub>4</sub>·NH<sub>2</sub> and nitroaminodurene shows that the steric effect of the o-Me on the large O of the  $NO_2$  is more important than that on the H of the  $NH_2$ . The anomalous behaviour of m-2-xylidine on nitration (4- and 6-positions but not 5-) is attributed to the steric effect of the o-Me which reduces the resonance, and hence the directing power of the NH<sub>2</sub>, to such an extent that the Me become the main directive influences. W. R. A.

Refractive indices and molecular refractivities of 3-methylcyclohexanone and pulegone. (MISS) D. M. SIMPSON (J.C.S., 1939, 886—889).—Vals. of nhave been obtained for  $\lambda\lambda$  from ~2500 to ~7000 A. by the thin film interference method. Both compounds show "optical exaltation" which substantiates the conclusion (A., 1936, 409) that the additivity of at. refractivities occurs only for mols. which do not show strong absorption bands in the accessible ultra-violet. W. R. A.

Rotatory dispersion and circular dichroism of santonide and parasantonide in the ultra-violet. S. MITCHELL and K. SCHWARZWALD (J.C.S., 1939, 889—893).—Santonide (I) and parasantonide (II) show the Cotton effect associated with a strong ketonic band which in EtOH solution has its max. at ~3000 A. For (I)  $\varepsilon_{max.} = 1000$ ,  $[\alpha] = +25,500^{\circ}$  at 3210 A.,  $-31,000^{\circ}$  at 2750 A.; for (II)  $\varepsilon_{max.} = 1170$ ,  $[\alpha] = +32,000^{\circ}$  at 3210 A.,  $-35,000^{\circ}$  at 2750 A. The vals. of  $[\alpha]$  are ~10 times the normal val. The max. of circular dichroism  $(\varepsilon_l - \varepsilon_r)$  are also abnormally large, but the anisotropy factors  $(\varepsilon_l - \varepsilon_r)/\varepsilon$  have normal vals. of 0.030 (I) and 0.038 (II).

W. R. A.

Loss determinations for dipole liquids and solid technical insulators for centimetre waves. G. Bžz (Physikal. Z., 1939, 40, 394—404).—Optical methods for the determination of the variation of n, and the absorption coeffs. of H<sub>2</sub>O, MeOH, and EtOH in their dispersion ranges for cm. waves are described. The dispersion curves are continuous with those obtained for longer  $\lambda$ . The dielectric consts. and angles of loss for a no. of solid insulators have been determined by the same method and over the same  $\lambda$  range, as well as for longer  $\lambda$  (100—3000 m.). The angle of loss increases with frequency. Dispersion for cm. waves was not observed with solid insulators. A. J. M.

Dynamic birefringence effect obtained during extension of a liquid film. G. DUCH (Compt. rend., 1939, 208, 1571—1572).—If a rectangular frame is withdrawn vertically from a liquid ( $C_6H_6$ or  $H_2O$ ) between crossed nicols, light is transmitted through two narrow bands parallel to the top of the frame. The positions of these bands probably correspond with max. in the traction curve for the film. The dynamic effects thus arise in the film, and do not depend on the nature of the support.

A. J. E. W. Nature of the most important kinds of chemical linking. E. THLO (Chem.-Ztg., 1939, 63, 449– 453).—A lecture.

Structure of phosphorus pentachloride in relation to the steric obstruction of atoms. H. MOUREU, A. M. DE FICQUELMONT, M. MAGAT, and G. WETROFF (Compt. rend., 1939, 208, 1579—1581).— The trigonal bipyramid structure for  $PCl_5$  (cf. A., 1937, I, 496; 1938, I, 606) provides for the most probable P—Cl distance (2.09 A.) and the most stable distance of approach (~ 3.70 A.) of two Cl which are not directly linked. Other structures involve less favourable vals. for these distances.

A. J. E. W. **New proof of the H theorem.** O. HALPERN and F. W. DOERMANN (Physical Rev., 1939, [ii], 55, 1077—1082).—Mathematical. The new proof of Boltzmann's H theorem is based on the properties of the probability coeffs. which determine the transitions between different states of the total system or of any part of the system. N. M. B.

Diffraction of a current of chemical molecules. W. KREJCZY (Nature, 1939, 143, 762).—Weak chemical linkings may be broken by scattering at incidence on a diffraction grating. L. S. T.

Zero-point energy and lattice distances. J. CORNER (Trans. Faraday Soc., 1939, 35, 711—716).— Taking into account the increase of the lattice const. due to the introduction of the zero-point energy, approx. intermol. potentials are calc. for Kr, Xe, CO, and  $CH_4$ . The correction greatly reduces the discrepancy between vals. of *n* (exponent of intermol. distance) deduced from heats of sublimation and lattice consts. F. L. U.

Kinetic energy of polyatomic molecules.A.SAYVETZ (J. Chem. Physics, 1939, 7, 383—389).—Mathematical.Linear tetrat.mols., and  $C_2H_6$  are discussed.W. R. A.

Relation between internuclear distance, force constant, and energy of dissociation for carbonto-carbon linkages. J. J. Fox and A. E. MARTIN (J.C.S., 1939, 884–886).—A relation  $D = k_e r_e^2 / mn$ is combined with  $k_e r_e^5 = \text{const.}$ , and it is shown that  $Dr_e^3 = \text{const.}$  When U/D is plotted against  $r/r_e$  a Morse type of curve, applicable to all C-to-C linkages, is obtained. W. R. A.

Carbon-chlorine bond in the substituted ethylenes and benzenes. J. SHERMAN and J. A. A. KETELAAR (Physica, 1939, 6, 572-579).—The amount of double-bond character in the C-Cl bonds in the choro-ethylenes and -benzenes, calc. by the mol.orbital method, is in agreement with experimental vals. for resonance-shortening of these bonds obtained from electron diffraction data. L. J. J.

Surface tension and Lindemann frequency. L. SIBATYA and M. R. RAO (Nature, 1939, 143, 723).—A simple formula expressing  $\gamma$  in terms of mol. mass and the Lindemann frequency is deduced. L. S. T.

Identity between the Laue equation and the Bragg relation. A. CAVINATO (Z. Krist., 1939, 100, 439-440).—An elementary mathematical demonstration. I. McA.

Quantum-mechanical theory of X-ray interference in crystals. I. Derivation and general discussion of dynamical fundamental equations. G. MOLIÈRE (Ann. Physik, 1939, [v], 35, 272-296). W. R. A.

Quantum mechanical theory of Röntgen-ray interference in crystals. II. Dynamic theory of refraction, reflexion, and absorption of Röntgen rays. G. MOLLÈRE (Ann. Physik, 1939, [v], 35, 297—313; cf. supra).—An anisotropy with respect to X-rays and a change in the limiting angle of the Bragg total reflexion area are predicted and should be of observable magnitude in the neighbourhood of the absorption edge. O. D. S.

 $L_{\rm III}$  Absorption of iodine, barium, and some compounds of barium. E. H. GREEN (Physical Rev., 1939, [ii], 55, 1072—1076).—The  $L_{\rm III}$  absorption limits of I<sub>2</sub>, Ba, BaI<sub>2</sub>, Ba(OH)<sub>2</sub>, BaBr<sub>2</sub>, BaH<sub>2</sub>, Ba(NO<sub>3</sub>)<sub>2</sub>, BaO<sub>2</sub>, and BaF<sub>2</sub>, were examined with a twocrystal spectrometer. No secondary structure was detected in the I<sub>2</sub> limit; a prominent absorption line was observed for Ba and each of its compounds, more prominent in the compounds than in the element. Some of the compounds, notably BaF<sub>2</sub>, showed secondary structure, and curves were obtained showing the changes as Ba absorbers changed in air to Ba(OH)<sub>2</sub>. The  $L_{\rm III}$  level of Ba is not wider than 4.06 v.

N. M. B. Structure of iron pentacarbonyl and of iron and cobalt carbonyl hydrides. R. V. G. EWENS and M. W. LISTER (Trans. Faraday Soc., 1939, 35, 681-691; cf. A., 1939, I, 13).—Study of the electron diffraction of the vapours indicates that  $Fe(CO)_5$  has a trigonal bipyramidal structure, whilst the hydrides show a tetrahedral arrangement of CO groups and should be formulated  $Fe(CO)_2(COH)_2$  and  $Co(CO)_3$ ·COH, respectively. The metal-C bonds, when compared with the sums of the single bond covalent radii, show shortenings similar to those found in other metal carbonyls. F. L. U. Crystal structure of  $\beta$ -FeO·OH. O. KRATKY and H. NOWOTNY (Z. Krist., 1938, 100, 356—360; cf. A., 1936, 562; Weiser, A., 1935, 433).—From powder X-radiograms (Co K $\alpha$ ) confirmed by a fibre photograph, the revised rhombic cell has 8 mols. with  $\alpha$  10·2, b, 10·5, c 3·03 A. The difference between calc. (3·67) and observed (3·1—3·4)  $\rho$  is due to adsorbed H<sub>2</sub>O which stabilises the  $\beta$ -form. Genesis and structural relations with the  $\alpha$ - and  $\gamma$ -forms are discussed. I. McA.

Unit cell and probable space-group of strontium hydroxide octahydrate,  $Sr(OH)_2, 8H_2O$ . D. P. MELLOR (Z. Krist., 1939, 100, 441-442). Natta's structure (A., 1929, 244) is incorrect. The cell has a 8.97, c 11.55 A.; 4 mols. per cell;  $\rho$  1.885. Analysis of reflexions on Laue and oscillation X-radiograms favours the space-group  $D_{4h}^2$ -P4/mcc.

I. McA.

Theoretical structural examination of the habit of sodium chlorate. W. HEINTZE (Z. Krist., 1938, 100, 285–296; cf. Berg, A., 1938, I, 243).— The habit of NaClO<sub>3</sub> grown from solution depends on solvent, concn., and added salts. Results and views, chiefly of Buckley and of Seifert, are surveyed. The relative effects of Na<sub>2</sub>S<sub>2</sub>O<sub>6</sub>, NaNO<sub>3</sub>, Na<sub>2</sub>SO<sub>4</sub>, Na<sub>2</sub>CrO<sub>4</sub>, and NaClO<sub>4</sub> are related to the measure of agreement between the spatial and charge distribution of the ions in the terminal faces of these salts and NaClO<sub>3</sub>. I. McA.

Crystal structure of neodymium bromate enneahydrate, Nd(BrO<sub>3</sub>)<sub>3</sub>,9H<sub>2</sub>O. L. HELMHOLZ (J. Amer. Chem. Soc., 1939, 61, 1544—1550).— Single crystals of Nd(BrO<sub>3</sub>)<sub>2</sub>,9H<sub>2</sub>O were prepared by adding hot Ba(BrO<sub>3</sub>)<sub>2</sub> to Nd<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>, filtering, and evaporating slowly. Chiefly they were fine, pink, hexagonal prisms, space-group  $C_{6v}^{4}$ —C6mc, 1·98 mols. per unit cell, interfacial (10·0 : 10·1) angle 56° 45′, a : c 1·736 : 1. In Nd(OH<sub>2</sub>)<sub>9</sub> " the Nd ions are surrounded by 9 H<sub>2</sub>O mols., six at the corners of a trigonal prism, at a distance  $2\cdot47\pm0\cdot05$  A., and three out from the prism faces at a distance  $2\cdot51\pm0\cdot05$  A., space-group approx.  $D_{3h}$ . For the BrO<sub>3</sub> group the following dimensions are given : Br—O  $1\cdot74\pm0\cdot07$ ; O—O  $2\cdot75\pm0\cdot10$  A.; angle OBrO  $105\pm10^{\circ}$ . The location of H bonds is considered and vals. of different H bond angles are given. A certain degree of randomness is suggested by the intensity relationships. W. R. A.

Co-ordination of aluminium in andalusite. P. C. THORNELY and W. H. TAYLOR (Mem. Manchester Phil. Soc., 1939, 83, 17—30).—A Fourier projection of the structure of andalusite  $(Al_2SiO_5)$  on the plane (001) has been carried out. It indicates the existence of the  $(AlO_5)$  group, which is linked with octahedral  $(AlO_6)$  groups and tetrahedral  $(SiO_4)$  groups. The dimensions of these structural units are also obtained. A. J. M.

Determination of lattice constants of triclinic crystals from one crystal setting : special case. T. ITO (Z. Krist., 1939, 100, 437-439; cf. Buerger, A., 1937, I, 399).—Where, as frequently occurs (wollastonite group, plagioclases), one axial angle is ~90°, a simplification of Buerger's equi-inclination Weissenberg diagrams suffices. The procedure is illustrated for schizolite (from ussingite, Greenland) giving :  $a 8.09, b 7.24, c 7.05 \text{ A}, \alpha 90^{\circ}, \beta 95^{\circ} 22', \gamma$ 101° 56'; 2 mols.  $\text{HNa}(\text{Ca},\text{Mn})_2\text{Si}_3\text{O}_9$  per cell;  $\rho$ ~2.90. I. McA.

Lattice structure of natural cellulose. H. KIESSIG (Z. physikal. Chem., 1939, 43, B, 79–102). —A crit. consideration of existing and new data on X-ray diagrams of natural cellulose shows that no model so far advanced accounts for all the facts. W. R. A.

Exact determination by means of electron beams of lattice constants for different sizes of crystallite. H. BOOCHS (Ann. Physik, 1939, [v], 35, 333—349).—The lattice plane distances in small Ni crystallites (about 16 A.) are > in large crystallites (about 30 A.). Au crystallites down to 20 A. have the same consts. as large crystals. Lattice consts. of NaCl, KCl, NaBr, and LiCl agree to  $\pm 1.5\%$  with X-ray vals. (cf. Finch and Fordham, A., 1935, 274). O, D, S.

Magnetisation of pyrrhotite crystals. S. KAYA and S. MIYAHARA (Sci. Rep. Tôhoku, 1939, 27, 450– 458).—Magnetic anisotropy measurements on a perfect pyrrhotite crystal from Asio (Japan) show hexagonal symmetry. D. F. R.

Pleochroism of sodium nitrate crystal. B. MUKHOPADHYAY (Z. Krist., 1938, 100, 308—315; cf. Krishnan, A., 1933, 1109).—For the  $\lambda$  range 2531— 3346 A., measurements have been made of the absorption coeffs. for the two extinction directions on the flat (1011) face of thin crystal plates. The derived principal molar absorption coeffs. are 1200, 16,000, respectively, at 2960 A., the region of max. absorption, and are also those of the NO<sub>3</sub>' ions owing to parallel orientation. Comparison of these vals. with corresponding data for cryst. KNO<sub>3</sub> and aq. NO<sub>3</sub>' solutions shows the dependence of the principal coeffs. of NO<sub>3</sub>' on environment. Measurements of birefringence for NaNO<sub>3</sub> have been extended to 3118 A. I. McA.

Structure and optical properties of iridescent glass. (SIR) C. V. RAMAN and V. S. RAJAGOPALAN (Proc. Indian Acad. Sci., 1939, 9, A, 371-381).— Examination of 30 photomicrographs (reproduced) of numerous specimens of decomposed glass reveals 6 distinct optical phenomena corresponding with 6 different structures. Contrary to Brewster's observation, the iridescence of decomposed glass does not disappear on immersion in a liquid; the colours actually become more vivid but the intensity is much less. Changes of colour occur with absorption of liquid. This indicates an openness of internal structure which is confirmed by observations on the polarisation of reflected light, and on the effect of mechanical pressure on the iridescence. W. R. A.

Reflectivities of evaporated metal films in the near and far ultra-violet. G. B. SABINE (Physical Rev., 1939, [ii], 55, 1064—1069).—Reflectivities were determined photographically, and curves plotted against  $\lambda$  are given from the visible to 450 A. for the following metals : Al, Sb, Be, Bi, Cd, Cr, Cu, Au, Fe, Pb, Mg, Mn, Mo, Ni, Pd, Pt, Ag, Te, Ti, Zn, and Zr. For the region 5000—2400 A., a quartz Hg arc with calibrated wire screens and a quartz prism spectrograph were used, and for the region 2400—450 A., a

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vac. spectrograph with grating, a discharge tube, and oiled photographic film. Accuracy is 3-5%. N. M. B.

Variation of Young's modulus for iron at low temperatures. M. BARBARON (Compt. rend., 1939, 208, 1559—1561).—The curve showing the variation of  $Y_{\theta}/Y_0$  with  $\theta$  (-180° to 25°) for a 0.1-mm. Fe wire contains several inflexions and a marked anomaly at -40°; the latter corresponds with an anomaly in the thermal expansion (cf. A., 1930, 986), but no irregularity in the electrical resistance variation can be detected. A thermal hysteresis effect, resulting in an increase in Y, is observed. A. J. E. W.

Dependence of the modulus of elasticity, elastic limit, and tensile strength of palladium on its hydrogen content. F. KRÜGER and H. JUNGNITZ (Z. tech. Physik, 1936, 17, 302—306; Chem. Zentr., 1936, ii, 3059).—Data for Pd wires are recorded. The initial adsorption of at. H causes an increase in all three factors, which subsequently fall in proportion to the [H] as  $H_2$  is adsorbed in the mol. form.

A. J. E. W. State of atoms in plastically deformed metals. N. F. LASCHKO and B. G. PETRENKO (Trans. Inst. Chem. Charkov Univ., 1938, 4, No. 13, 65—70).— Theoretical. No analogy exists between modification of the state of atoms due to temp. change or to plastic deformation. R. T.

Magnetoresistance of nickel in large fields. C. W. HEAPS (Physical Rev., 1939, [ii], 55, 1069— 1071).—Measurements in fields up to 24,000 gauss give curves showing a drop in large fields, in agreement with Gerlach's theory that a resistance decrease  $\infty$  the square of the increase of spontaneous magnetisation is produced. The const. of proportionality is dependent on the temp. It is concluded that spontaneous magnetisation may be increased by a magnetic field, even up to 200,000 gauss, without saturation appearing. N. M. B.

Relaxation connected with the transition from the superconducting to the normal state. P. H. VAN LAER and H. J. GROENEWOLD (Physica, 1939, 6, 473—480).—Existing experimental evidence is reviewed in support of the view that there is an essential difference between the time effects observed in magnetic properties in the transition from the superconductive to the normal states and thermal relaxation effects, and between the thermally-induced transition and that dependent on the external field. L. J. J.

Threshold and equilibrium curves for superconductors. J. G. DAUNT (Phil. Mag., 1939, [vii], 28, 24—33; cf. A., 1936, 556; 1937, I, 541).— An investigation of the crit. magnetic fields required to disturb the superconductivity at different temp. as measured by resistance and by induction, for Pb, Sn, and Hg. The threshold vals. of Sn and Hg agreed well with previous results but marked differences were noted for Pb. With Pb the change to zero resistance becomes more gradual as the temp. is lowered. It is suggested that this may be quite general in high magnetic fields. T. H. G.

Diamagnetism of an electron gas. III. A. PAPAPETROU (Z. Physik, 1939, 112, 587-604; cf. A., 1937, I, 404, 591).—Theoretical. The  $\chi$  is calc. for a rectangular parallelepiped in weak fields and a dependence is found between  $\chi$  and the shape of the space. It is shown that for all practical fields an abnormally strong diamagnetism, independent of shape, is to be expected. L. G. G.

Effect of small proportions of foreign substances on the magnetic properties of platinum. (MILE.) R. THÉRON (Compt. rend., 1939, 208, 1634—1636).—The 1/χ-θ curves for pure Pt (20° to  $-180^\circ$ ) consist of intersecting straight lines corresponding with at. moments of 8.5 (above  $-55^{\circ}$ ), 10.5 ( $-55^{\circ}$  to  $-120^{\circ}$ ), and 13  $\mu_{w}$  (below  $-120^{\circ}$ ). Heat-treatment at  $> 1000^{\circ}$  causes parallel displacement of these lines. In presence of  $Mn (\langle 0.1 \rangle_0)$  or traces of C, the apparent at. moment is considerably modified by heat-treatment; with Mn the curve becomes a straight line  $(8 \,\mu_w)$  down to  $-170^\circ$ , and moments of 6, 7.3, and  $9 \mu_w$  can be obtained with C. Addition of 2-5% of Au to pure Pt causes similar changes (moment  $9 \mu_w$ ), showing that diamagnetic atoms are responsible for the effects, which account for the existence of specimens of Pt having different magnetic properties (A., 1931, 1357). The impurities may have a catalytic effect on magnetic transformations.

A. J. E. W. Paramagnetic solutions. Comparison of the laws of thermal variation of magnetic rotatory power and of susceptibility. H. OLLIVIER (Ann. Physique, 1939, [xi], 11, 461-503).-Investigation of the thermal variation of the sp. magnetic rotatory power G (calc. on the basis of additivity from the measured vals. of the magnetic rotatory power of solutions) and of the susceptibility,  $\chi$ , of various salts leads to the classification : (i) diamagnetic salts with a positive rotation (salts of Zn, Na, Mg), thermal variation of G is zero or insignificant like the thermal variation of  $\chi$ ; (ii) paramagnetic salts with a negative rotation (salts of Ce, Nd, Pr, Er, Fe", and alkali dichromates), thermal variation of G analogous to that of  $\chi$ ; (iii) paramagnetic salts with a small positive rotation (salts of Mn, Gd, Fe""), magnetic rotatory power of the cation is zero; (iv) paramagnetic salts with a positive rotation (Ni salts), cation behaves from the viewpoint of magnetic rotation as a diamagnetic ion. W. R. A.

Magnetic properties of some salts of the iron group at low temperatures. W. J. DE HAAS and B. H. SCHULTZ (Physica, 1939, 6, 481–496; cf. A., 1939, I, 188).—The susceptibility and remanence of the anhyd. salts  $CoCl_2$ ,  $CoBr_2$ ,  $CoF_2$ , and  $Ti_2(SO_4)_3$ , and also of  $Mn(OAc)_3, 2H_2O$  have been studied as a function of temp. and field-strength up to 23,000 gauss. L. J. J.

Magnetic flux distribution when a cylinder of constant permeability is placed in a homogeneous field. Magnetic susceptibility of gadolinium oxide at low temperatures. W. F. GIAUQUE and J. W. STOUT (J. Amer. Chem. Soc., 1939, 61, 1384—1393).—The magnetic susceptibility,  $\chi$ , of a solid may be calc. from measurements of the flux of induction (a) through coils located at various positions about a cylindrical sample as well as (b) in coils surrounding an ellipsoidal sample. Measurements have been made at low temp.  $(1.5 - 88^{\circ} \text{ K.})$  with  $\text{Gd}_2\text{O}_3$ , a paramagnetic substance of relatively high and field-independent  $\chi$ . The vals. of  $\chi$  obtained from (b) were used to interpret the readings obtained from (a). W. R. A.

Influence of water on the magnetic constants of the rare-earths. B. CABRERA (J. Chim. phys., 1939, 36, 117—129).—A detailed account of work already noted (cf. A., 1939, I, 131). W. R. A.

Magnetic anisotropies of some organic crystals in relation to their structures. S. BANERJEE (Z. Krist., 1938, 100, 316—355; cf. A., 1935, 924; Lonsdale, A., 1937, I, 18).—A comprehensive and detailed review is given, with further (including X-ray) measurements. Magnetic anisotropies, principal and mean molar susceptibilities, and related crystallographic data are listed for 33 aromatic compounds selected for their fundamental structural significance and containing from 1 to 5 separate or condensed ring nuclei. Many orientations of mols. or ring planes are derived, and the results confirmed by, or discussed in relation to, mol. and cryst. structures as found by other (chiefly X-ray) methods.

I. McA.

Diamagnetic susceptibilities of some nonaromatic organic crystals. K. BANERJEE and J. BHATTACHARYA (Z. Krist., 1939, 100, 420—424).— Previous methods and technique are outlined and applied, with X-ray measurements, to the structure analysis of guanidine carbonate,  $(CN_3H_6)_2CO_3$  (I), artostenone (II), and decahydro- $\beta$ -naphthol (III). (I) is tetragonal, a 6.95, c 19.45 A.; 4 mols. per cell; space-group  $D_4^4$  and  $D_{4,}^8$ , the mol. possessing thus a 2-fold axis of symmetry.  $\chi_c - \chi_a$ ,  $\chi_a$ ,  $\chi_c$  are (all ×  $10^{-6}$ ) 1.418, -98.6, -97.2 e.m.u., respectively. (II) is monoclinic, a 17.25, b 10.25, c 7.45 A.,  $\beta$  100° 16'; 2 mols. per cell;  $\chi_1$ ,  $\chi_2$ ,  $\chi_3$  —170.85, -182.27, -170.99, respectively. (III) is rhombic with  $\chi_a$ ,  $\chi_b$ ,  $\chi_c$  —34.08, -25.39, -42.01, respectively. To a smaller extent than in aromatic compounds, ring structure gives rise to magnetic anisotropy. Mol. orientations are sketched. I. McA.

Absorption of sound in CO<sub>2</sub> gas, in CO<sub>2</sub> containing small quantities of  $H_2$ ,  $D_2$ ,  $H_2O$ ,  $D_2O$ , and in mixtures of CO<sub>2</sub> and O<sub>2</sub>. Collision efficiencies. A. VAN ITTERBEEK, P. DE BRUYN, and P. MARIËNS (Physica, 1939, 6, 511—518).—Data are recorded for absorption of sound in highly purified CO<sub>2</sub> at 599 khz., for 1 atm. and temp. 18—50°. Small amounts (<1%) of H<sub>2</sub>, D<sub>2</sub>, H<sub>2</sub>O, and D<sub>2</sub>O markedly increase the absorption, but with increasing proportions of O<sub>2</sub> a continuous decrease to the classical val. at 100% O<sub>2</sub> is found. For pure CO<sub>2</sub> the relaxation time and collision efficiency for vibrational excitation, and for the admixtures the relative collision efficiencies, are calc. The latter is zero for O<sub>2</sub>. L. J. J.

Dispersion of ultrasonic velocity in liquids. K. G. KRISHNAN (Proc. Indian Acad. Sci., 1939, 9, A, 382–385).—Measurements of the ultrasonic velocity in xylene,  $C_6H_6$ ,  $CCl_4$ ,  $CS_2$  (frequencies 1.5 to 7 mc.), and  $H_2O$  (frequencies 1.5 to 22.5 mc.) reveal no definite evidence of acoustic dispersion.

W. R. A.

Frequency change of light in diffraction by ultrasonic waves. F. LEVI (Helv. Phys. Acta, 1936, 9, 234—244; Chem. Zentr., 1936, ii, 932).— Raman and Nath's theory (A., 1936, 555) is generalised and extended to give the v change in a wave-train or in standing waves. The results are compared with experimental data (Bär, A., 1937, I, 174; Ali, A., 1938, I, 129). A. J. E. W.

Fusion of graphite under pressures of argon of from 1 to 11,500 kg. per sq. cm. Determination of the triple point and the construction of a provisional diagram for the solid, liquid, and gaseous states of carbon. J. BASSETT (J. Phys. Radium, 1939, [vii], 10, 217-228).-The fusion of graphite under various pressures of A (1 to 11,500 kg. per sq. cm.) has been investigated by means of an apparatus which is described. The triple point co-ordinates are 105 kg. per sq. cm. and 4000° K. No conclusive data on the variation of the temp. of fusion with pressure have been obtained. Graphite. melted under 4000 kg. per sq. cm., has d 2.25 and crystallises on cooling, under this pressure and at pressures up to 11,500 kg. per sq. cm., in the form of graphite. A provisional diagram for the three states of C is put forward and discrepancies between the temp. of C in an electric arc and the measured temp. of sublimation are discussed. W. R. A.

True specific heat [of platinum and] of nickel above the Curie point. B. PERSOZ (Compt. rend., 1939, 208, 1632—1634; cf. B., 1939, 618).—For Pt at 0—1000°,  $c_p = 0.0312 + (6.29 \times 10^{-6})\theta$ ; for Ni at 400—1000°,  $c_p = 0.119 + (29.2 \times 10^{-6})\theta$ .

A. J. E. W. Internal rotation in dimethylacetylene. B. L. CRAWFORD, jun. and W. W. RICE (J. Chem. Physics, 1939, 7, 437).—Comparison of calc. and observed heat capacities of gaseous (CMei)<sub>2</sub> indicates that free internal rotation of the Me groups against each other occurs with a restricting potential barrier of <500 g.-cal. per mol. From unpublished Raman and infra-red data vals. of  $C_p^o$ , the heat capacity of the ideal gas (exclusive of the contribution from internal rotation), have been obtained. The heat capacity of the gas has been measured at 336° and 369° K. by the adiabatic expansion method (A., 1939, I, 362) and corr. to  $C_p^o$ . W. R. A.

Analogues of entropy. T. H. HAZLEHURST (J. Physical Chem., 1939, 43, 759-765).—Entropy and temp. have properties analogous to other extensive and intensive energy factors respectively.

W. R. A.

Thermodynamical properties of some superconductors. J. G. DAUNT, A. HORSEMAN, and K. MENDELSSOHN (Phil. Mag., 1939, [vii], 27, 754— 764).—The equilibrium curves of Tl and In have been determined between  $1^{\circ}$  K. and the transition point, and previous measurements on Sn and Pb (A., 1937, I, 451) have been supplemented. The differences in entropy and sp. heat between the normal and superconductive states for the four metals have been evaluated, and the sp. heat of the system of superconductive electrons has been determined. For Sn the vals. of the sp. heat derived from the equilibrium curve agree with the vals. obtained by direct calorimetric measurements. It is concluded that all free electrons are in the superconductive state at  $0^{\circ} \kappa$ ., and the sp. heat of the system of superconductive electrons is interpreted to indicate a decrease in the no. of these electrons with temp. W. R. A.

Persistence of liquid structure in the critical region. J. DACEY, R. MCINTOSH, and O. MAASS (Canad. J. Res., 1939, 17, B, 145).—When a mixture of  $C_2H_4$  liquid and vapour is heated just above the crit. temp.  $T_e$  (as defined by disappearance of a meniscus) a heterogeneity presists until it is removed by "mol. stirring," heating to 5° above  $T_e$  and cooling again, or by isothermal expansion. When the upper portion of the tube only is superheated, however, a heterogeneity in the lower portion persists even after the upper portion is cooled to the original temp. It therefore appears possible to produce dense and less dense media in equilibrium with one another above  $T_e$ . J. W. S.

Phase equilibria in hydrocarbon systems. Latent heat of vaporisation of propane and *n*pentane. B. H. SAGE, H. D. EVANS, and W. N. LACEY (Ind. Eng. Chem., 1939, **31**, 763—767).—The latent heats of evaporation (L) of  $C_3H_8$  and  $n-C_5H_{12}$ have been determined at 100—170° F. and 80—200° F., respectively. The changes of L with temp. are in accord with the theoretical vals. deduced from the isobaric heat capacity and the isothermal pressure coeff. of the enthalpy for the saturated liquid and vapour. J. W. S.

Specific heats and heats of fusion and transition of carbon tetrabromide. K. J. FREDERICK and J. H. HILDEBRAND (J. Amer. Chem. Soc., 1939, 61, 1555—1558).—CBr<sub>4</sub> (m.p. 90·1°, transition point 46·9°), by the method of mixtures, gives : heat of fusion at m.p.,  $945\pm25$ ; heat of transition,  $1420\pm15$ ; molal heat capacity from 25° to 46·9°,  $35\cdot0\pm0\cdot5$ ; from 46·9° to 90·1°,  $42\cdot9\pm0\cdot3$ ; from 90·1° to 150°,  $36\cdot7\pm0\cdot5$ g.-cal. per mol. W. R. A.

Densities of liquid organic compounds. A. RAMAT (Bull. Soc. chim., 1939, [v], 6, 957—963).— From measurements of  $d^0$  for various org. compounds the following mol. vol. contributions of radicals have been deduced : C ~0, CH 3.8, CH<sub>2</sub> 16.3, Me 30, Ph 73.7, N ~0, NH 6.5, NH<sub>2</sub> 17, NO<sub>2</sub> ~23, O 7, OH 10.5, Cl 23, Br 26.5, I 33, CO 11, CO<sub>2</sub> 25, CO<sub>2</sub>H 27.5, CHO 25, and CN 20 c.c., respectively. The group mol. vol. relationship is more closely followed than the at. vol. law of Kopp and is not restricted to vals. measured at the b.p. J. W. S.

Theory of liquid structure. E. P. IRANY (J. Amer. Chem. Soc., 1939, 61, 1436—1443).—Liquids are assumed to be systems of two phases in equilibrium; one of these consists of a two-dimensional mol. lattice structure, whilst the other occupies the remaining space and is in a gaseous condition. Equilibrium depends on temp. but not on the external pressure. An equation of the liquid state involving P, V, T,  $\gamma$ , and  $\eta$  has been developed and holds for a large no. of pure liquids and mixtures. W. R. A. Vapour pressure of o- and p-H<sub>2</sub> and D<sub>2</sub>. К. Сонем and H. C. UREY (J. Chem. Physics, 1939, 7, 438).—Mathematical. (Cf. A., 1939, I, 248.) W. R. A.

Mol. wt. and vapour pressure of selenium. K.NEUMANN and E.LICHTENBERG (Z. physikal. Chem., 1939, 184, 89–99).—The average val. for the mol. wt. of Se vapour at 200° is 476, indicating a degree of association corresponding with Se<sub>6</sub>. V.p. data for solid and liquid Se have been obtained and used to calculate the heats of vaporisation of solid and liquid Se, viz., 33.92 and 24.58 kg.-cal. per mol. respectively, and the heat of fusion, viz., 9.34 kg.-cal. per mol. C. R. H.

Thermodynamic properties of methyl chloride. H. G. TANNER, A. F. BENNING, and W. F. MATHEW-SON (Ind. Eng. Chem., 1939, **31**, 878–883).—Tables serviceable to refrigeration engineers have been computed from published data by equations relating the various thermodynamic properties. V.p. for the range  $-80^{\circ}$  to  $170^{\circ}$  F., sp. vol., heat content, and entropy of the saturated vapour from  $-40^{\circ}$  to  $170^{\circ}$  F., and of superheated vapour at pressures of 6—200 lb. per sq. in. are given. (Misprints occur in the last 8 vals. for sp. vol. of saturated vapour.) F. L. U.

Thermodynamic properties of chlorofluoromethanes and -ethanes. A. F. BENNING and R. C. MCHARNESS (Ind. Eng. Chem., 1939, 31, 912— 916).—Measurements of v.p.,  $\rho$ , and heat capacity of liquid and vapour, and  $C_p/C_v$  for the vapour, for CHClF<sub>2</sub>, CHCl<sub>2</sub>F, CCl<sub>3</sub>F, and CCl<sub>2</sub>F·CClF<sub>2</sub> are recorded. F. L. U.

Second virial coefficient of helium gas for the lowest measured temperature. L. GROPPER (Physical Rev., 1939, [ii], 55, 1095—1097; cf. A., 1937, I, 453).—Calculations analogous to those of Massey and Buckingham with the Slater–Kirkwood potential (cf. A., 1939, I, 135) are made with the Slater–Margenau potential. Results indicate that the real potential must lie somewhere between these two. N. M. B.

Problem in heat conduction. H. W. WOOLLEY (Phil. Mag., 1939, [vii], 27, 706-708).—Mathematical. W. R. A.

Joule-Thomson inversion curves of recent equations of state. J. CORNER (Trans. Faraday Soc., 1939, 35, 784—791).—Inversion curves computed for the equation of state of Lennard-Jones and Devonshire (A., 1938, I, 130) are in fair agreement with experimental results at high but not at low  $\rho$ . The equation of de Boer and Michels (A., 1939, I, 248) gives fair agreement at low  $\rho$ . The latter equation gives better vals. for  $P_c$  and  $V_c$  than does the former, but not so good for  $T_c$ . F. L. U.

Surface transport in liquid helium II. J. G. DAUNT and K. MENDELSSOHN (Nature, 1939, 143, 719-720; cf. A., 1938, I, 566).—Experiments which show that a transfer of He II from a colder to a hotter place occurs when a temp. gradient is imposed, and that the flow of liquid He II through a plug of powdered emery is accompanied by a caloric effect, are described. They support the view that the trans-

port phenomena in liquid He II are due mainly to surface flow. L. S. T.

Internal friction of gases. I, II. S. WEBER (Physica, 1939, 6, 551-561, 562-571).—I. The viscosity-pressure relation found by van Itterbeek and Keesom (A., 1938, I, 304) for He at low temp. is deduced theoretically.

II. A general viscosity-temp. relation valid for a no. of mono- and di-at. gases, but not for He and  $H_2$ , is deduced. L. J. J.

Viscosity of compounds and the limiting volume of sulphur. G. P. LUTSCHINSKI (J. Phys. Chem. Russ., 1938, **12**, 280—285).—Vals. are recorded for  $\eta$  of SO<sub>2</sub> between -40° and 0°, of SO<sub>3</sub> between 15° and 40°, of SCl<sub>2</sub> between 0° and 15°, of S<sub>2</sub>Cl<sub>2</sub> between -15° and 100°, of SOCl<sub>2</sub> between -15° and 60°, of SO<sub>2</sub>Cl<sub>2</sub> between -10° and 60°, of S<sub>2</sub>O<sub>5</sub>Cl<sub>2</sub> between 0° and 90°, and of S<sub>3</sub>O<sub>7</sub>Cl<sub>4</sub> between 10° and 40°. All the vals. agree with Batschinski's equation. Assuming the additivity of the at. limiting vols. the limiting vol. of S becomes 15·7 c.c.; it agrees with the vol. calc. from the  $\eta$  of free S between 120° and 155°.

J. J. B.

Viscosity of liquids. A. H. NISSAN and L. V. W. CLARK (Nature, 1939, 143, 722—723).—When  $\log \eta$ of the *n*-paraffins from  $n \cdot C_4 H_{10}$  to  $n \cdot C_{18} H_{38}$  is plotted against  $T_{b.p.}/T$  a smooth curve is obtained, showing that a sp. viscosity curve is given by a homologous series provided that the first few members are excluded. In the formula  $\eta = Ae^{B/T}$ , B is not invariant with temp. as is generally assumed. Examination of 137 liquids shows that they can be classified into (i) unassociated liquids and liquids which do not change their degree of association with temp., (ii) associated liquids, and (iii) metallic liquids. L. S. T.

Plastic-elastic state. K. BENNEWITZ and H. Rötger (Physikal, Z., 1939, 40, 416–428).— Theoretical. A. J. M.

Representation of the viscosity of binary gas mixtures by the gas-kinetic mixture formula. E. SCHRÖER (Z. physikal. Chem., 1939, 43, B, 103— 108).—For the mixtures  $H_2$ – $CH_4$ ,  $H_2$ – $C_2H_6$ ,  $H_2$ – $C_2H_2$ ,  $H_2$ – $C_3H_6$ ,  $CH_4$ – $C_2H_2$ ,  $C_2H_2$ – $C_3H_6$ , and  $C_3H_8$ – $C_3H_6$ ( $C_3H_6$  = CHMe:CH<sub>2</sub>) vals. of  $\eta$  calc. by Sutherland's mixture equation (cf. A., 1937, I, 72) do not agree with the experimental vals. of Adzumi (cf. *ibid.*, 405), due probably to impurities in the gases used. W. R. A.

Influence of solvents and of other factors on the rotation of optically active compounds. XXXVII. Asymmetric solvent action (continued). T. S. PATTERSON, A. H. LAMBERTON, and R. M. CUNNINGHAM (J.C.S., 1939, 962—967; cf. A., 1937, I, 513).—The effect of admixture on the rotation of nicotine has been studied for Et d-, dl-, and *i*-tartrates and Bu<sup> $\beta$ </sup> d-, l-, dl-, and *i*-tartrates. The observed rotations of the mixtures compare unfavourably with the rotations calc. on the basis of additivity, except for the nicotine–Bu<sup> $\beta$ </sup> dl-tartrate mixture. The discrepancies are due to a mutual solvent effect, each component of the mixture affecting the rotation of the other. Bu<sup> $\beta$ </sup> i-tartrate, prepared by the Fischer–Speier method, has m.p. 81—82°, b.p. 176—178°/12 mm.,  $\varphi_{1^{40}}^{10}$  1.0216 (molten state). W. R. A.

Viscosity of aqueous solutions of strong electrolytes. V. Viscosity of aqueous solutions of cerite earth nitrates as an indication of their basicity. H. TOLLERT (Z. physikal. Chem., 1939, 184, 165–178).—Data are recorded for  $\eta$  and  $\rho$  of solutions of  $La(NO_3)_3$ ,  $Ce(NO_3)_3$ ,  $Ce(SO_4)_2$ ,  $Pr(NO_3)_3$ ,  $Nd(NO_3)_3$ , and  $Sm(NO_3)_3$  alone, and in presence of the corresponding acid with const. acid/salt ratio, and also for the acids alone. In presence of  $HNO_3 \eta$  at low concns. is <, and at high concns. is >, when  $HNO_3$  is absent. This behaviour is attributed to repression of hydrolysis in presence of HNO<sub>3</sub>. Calculations of the degrees of hydrolysis have been made on the basis of the author's theory (cf. A., 1935, 443) from data for the sp.  $\eta$  of the various ions. The similarity between the plots of sp.  $\eta$  and reduction potential against the at. nos. of the earths is discussed. C. R. H.

Viscosity of the liquid phase of frozen solutions of the sea-water type. D. M. KORF and N. A. ZACHAROVA (J. Appl. Chem. Russ., 1939, **12**, 234— 237).—The  $\eta$  of sea-H<sub>2</sub>O between  $-10^{\circ}$  and  $20^{\circ}$  is expressed by  $\eta = \eta_0(1 + a\theta + b\theta^2)$ , where  $\eta_0$  is the  $\eta$  at 0°,  $\theta$  is the temp., and a and b are consts.

R. T. Aqueous solutions of electrolytes. R. LAUTIÉ (Bull. Soc. chim., 1939, [v], 6, 963—970).—The mol. heat of dilution, fraction of undissociated mols., variation in viscosity, and apparent vol. of dilute electrolyte solutions of concn. c can be expressed by the general relation  $Y = p\Delta/(1 + q\Delta)$ , where p and q are consts. dependent on the temp. and the electrolyte concerned, and  $\Delta = \Lambda_0 - \Lambda_c$ . For strong electrolytes of low and medium concn. this relation can be expressed  $Y = p_2\sqrt{c}/(1 + q_2\sqrt{c})$ . J. W. S.

Micro-crystallisation studies with supersaturated solutions. A. TSCHERMAK-SEYSENEGG (Mikrochem., 1939, 27, 96—111).—Supersaturated solutions or melts of NaOAc, KOAc, Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>, salol, K alum, and K Cr alum can be preserved indefinitely in absence of sp. nuclei. The immunity persists in presence of non-isomorphous crystals of other hydrates of the same substance. The seeding test is applicable as a micro-method for determining the coincidence or otherwise of space-lattice and crystal structure. A local cooling method is developed for seeding solutions in sealed tubes. Evolution of heat, but not of radiant energy, has been detected during crystallisation. The cause of the electrical charge production during crystallisation is discussed.

J. W. S. Phase relations and magnetic behaviour in the system titanium-oxygen. P. EHRLICH (Z. Elektrochem., 1939, 45, 362—370).—Oxides of composition between TiO<sub>2</sub> and TiO<sub>0.58</sub> have been prepared by heating mixtures of TiO<sub>2</sub> and Ti, and examined by X-rays. Four different lattice structures are observed, the  $\alpha$ -,  $\beta$ -,  $\gamma$ - and  $\delta$ -phases occurring over the composition ranges TiO<sub>2.00</sub>—TiO<sub>1.40</sub>, TiO<sub>1.40</sub>—TiO<sub>1.65</sub>, TiO<sub>1.56</sub>—TiO<sub>1.46</sub>, and TiO<sub>1.25</sub>—TiO<sub>0.6</sub>. The  $\beta$ -phase may be a distorted  $\alpha$ -phase. At the composition TiO<sub>1.00</sub> 15% of the lattice positions in the  $\delta$ -phase are unoccupied. An increase in the no. of Ti positions occupied, however, is always accompanied by a decrease in the no. of O positions, and vice versa, until at extreme compositions at which this phase is stable all the positions of one element are occupied. The magnetic properties indicate that Ti<sup>•••</sup> and Ti<sup>••</sup> ions form interat. linkings with one another, excepting at very high [Ti<sup>••••</sup>]. J. W. S.

Mixed oxide phases with an incomplete oxygen lattice. L. G. SILLÉN and B. AURIVILLIUS (Naturwiss., 1939, 27, 388—389).—In the systems PbO-Bi<sub>2</sub>O<sub>3</sub> and SrO-Bi<sub>2</sub>O<sub>3</sub> phases have been found in which, with varying composition, the no. of metal atoms in the lattice remains const., but the no. of O atoms is variable. In the PbO-Bi<sub>2</sub>O<sub>3</sub> system a homogeneous tetragonal phase was found with 40—68 at.-% Bi, the unit cell containing 2 metal atoms and  $2\cdot4-2\cdot7$  O. In the SrO-Bi<sub>2</sub>O<sub>3</sub> system a rhombohedral phase was found with 80—85 at.-% Bi, with 3 metal atoms and  $4\cdot2-4\cdot3$  O in the unit cell. A. J. M.

Structure of solid solutions. J. A. WASASTJERNA (Physical Rev., 1939, [ii], 55, 986—987).—X-Ray investigations indicate that in the case of a mixed crystal (KCl + KBr) the actual mean distances of the ions from the theoretical positions in a face-centred lattice cannot be entirely explained by thermal vibrations; hence the actual positions of equilibrium of the ions do not agree with the theoretical lattice points. An explanation is discussed in detail.

N. M. B.

Magnetochemistry of mixed crystals. N. PERAKIS and L. CAPATOS (J. Phys. Radium, 1939, [vii], 10, 234—240).—An extension and summary of work already noted (A., 1936, 786; 1938, I, 187).

W. R. A.

Physico-chemical investigations on the fine structure of glasses. III. Binary and pseudobinary glasses with insignificant packing effects. E. KORDES (Z. physikal. Chem., 1939, 43, B, 173— 190).—n, d, mol. vol., and mol. refractivity ([R]) data for glasses of the systems  $B_2O_3$ - $As_2O_3$  and piperinephenolphthalein indicate that these properties are almost strictly additive. On the other hand, in the system  $B_2O_3$ - $Sb_2O_3$  only the mol. refractivity is strictly additive, the mol. vol. being slightly < and nand d being > calc. vals. assuming additivity, max. variation occurring with an equimol. mixture. Strict additivity of mol. vol. is shown with piperine- $SbI_3$ systems, but [R] is > and n and d are < calc. vals.

C. R. H.

Molecular refraction of glasses. (A) E. KORDES. (B) W. BILTZ and F. WEIBKE (Z. anorg. Chem., 1939, 241, 418—420, 421—423).—Polemical (cf. Biltz and Weibke, A., 1939, I, 250). F. J. G.

Tempering of borate-soda glasses. M. Foëx (Bull. Soc. chim., 1939, [v], 6, 1056—1061; cf. A., 1939, I, 137).—Tempered and annealed  $Na_2O_3B_2O_3$ glasses both show only diffuse X-ray diffraction patterns, but devitrified glass shows a distinct line structure. This evidence supports the view that there is a distinct line of demarcation between the vitreous and cryst. states. J. W. S.

Structure of magnesium-strontium alloys. H. VOSSKÜHLER (Metallwirts., 1939, 18, 377-378).— Thermal analysis and micrographical examination of the alloys reveals the existence of a compound Mg<sub>9</sub>Sr,

m.p. 606°; this compound forms a eutectic with Mg at  $582^{\circ}$ , 18.4% Sr and with a Sr-rich phase at  $592^{\circ}$ , 39.8% Sr. The system is therefore analogous to the Mg–Ba system. A. R. P.

Conversion velocity of supersaturated solid solutions of magnesium-aluminium. I. I. KORNILOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, 21, 172—175).—The pptn. of the excess phase from supersaturated solid solutions containing 11.9% of Al has been studied at  $100-350^\circ$  by means of microstructure and hardness determinations. At temp. >300° the excess phase ppts. without perceptible ageing, at approx.  $100-300^\circ$  pptn. occurs with ageing, and at  $100^\circ$  the alloy shows no appreciable change during the time of observation. The change in microstructure shows that the conversion process begins at the grain boundaries and develops towards the interior of the grain. E. S. H.

Thermal and electrical conductivities of some magnesium alloys. R. W. POWELL (Phil. Mag., 1939, [vii], 27, 677-686).—The thermal (K) and electrical ( $\sigma$ ) conductivities of 8 alloys of Mg with Ce, Ni, Mn, Ca, and Co are recorded for 50°, 150°, and 250°. The data can be represented to within 3.5% by  $K = 0.526 \times 10^{-8}\sigma T + 0.027$ , where K is in g.-cal. per sq. cm. per sec. for 1 cm. thickness and 1° difference of temp., and  $\sigma$  in reciprocal ohms per c.c., and T in °K. Analysis of recorded data on Mg and Mg alloys leads to the general approx. equation  $K = 0.516 \times 10^{-8}\sigma T + 0.022$ . W. R. A.

Evidence for a superlattice in the nickel-iron alloy, Ni<sub>3</sub>Fe. P. LEECH and C. SYKES (Phil. Mag., 1939, [vii], 27, 742-753).-An alloy containing 24.91% Fe, 75.04% Ni, and <0.02% Al was used. The sp. heat, after quenching in  $H_2O$  from 700°, rises slowly to 380°, falls to a min. at 425°, and subsequently rises, passing through two max. at 525° and 590°. The max. at 590° corresponds with the Curie point; the min. results from the partial ordering of the quenched disordered alloy and at 525° the alloy returns to the disordered state. On cooling 1° per min. from 650° the sp. heat curve again shows two max. but no min., presumably because ordering has set in during cooling. When the alloy is cooled slowly from 490° to 370° in 150 hr. the max. at 525° is very high, indicating greater ordering, whilst the Curie point is not appreciably changed. Curves of magnetic saturation intensity against temp. are not affected by annealing, and hence the energy of the magnetic transformation is independent of the degree of order of the material. Whereas specimens quenched from 700° showed no superlattice lines, specimens annealed for 500 hr. from 490° to 370° showed these lines in correct no. and position. Previous attempts to adduce evidence for a superlattice are reviewed and ascertained data on Ni<sub>3</sub>Fe are compared with those for other order-disorder transformations. W. R. A.

Structure of the ternary silver-copperpalladium system in the solid state. F. GLANDER (Metallwirts., 1939, 18, 337-341; 357-362).--Micrographical examination and resistivity measurements show that the region of incomplete miscibility along the Cu-Ag side of the ternary diagram extends to Ag 25, Cu 50, Pd 25 at.-% at 870°, and to Ag 25, Cu 15, Pd 60 at.-% at 400°. The isothermals run very close to the Pd-Ag side at the lower temp., indicating that Pd-Ag solid solutions decompose at low temp. Addition of small amounts of Ag to Cu-Pd alloys displaces the CuPd and Cu<sub>3</sub>Pd transformations to slightly higher Pd contents. The ternary alloys are capable of pptn.-hardening over a wide range of composition.

A. R. P.

Magnesium corner of the magnesium-silverthallium system. W. Köster and K. KAM (Z. Metallk., 1939, 31, 84).—The solubility of Ag in Mg is reduced from 10% to about 4.5% by addition of 30% of TI. The hardness of Ag-Mg alloys is increased slightly and the corrosion in tap-H<sub>2</sub>O considerably by addition of TI, which also reduces the eutectic point progressively. A. R. P.

Mg-MgZn<sub>2</sub>-Mg<sub>5</sub>Tl<sub>2</sub> region of the magnesiumzinc-thallium system. W. Köster and K. KAM (Z. Metallk., 1939, 31, 82–84).—MgZn<sub>2</sub> and Mg<sub>5</sub>Tl<sub>2</sub> form a simple eutectiferous series with the eutectic at 360°, Mg 22, Zn 5, Tl 73%. The ternary system of these compounds with Mg has a ternary eutectic at 342°, Mg 25, Zn 4, Tl 71%. Tl additions increase the age-hardening of Zn-Mg alloys but decrease the resistance to corrosion. Addition of Zn to Tl-Mg alloys, on the other hand, increases their resistance to salt H<sub>2</sub>O. A. R. P.

Mg-MgZn-Mg<sub>3</sub>Bi<sub>2</sub> section of the magnesiumzinc-bismuth system. E. SCHEIL and B. GLAUNER (Z. Metallk., 1939, 31, 80-81).—Zn-Bi alloys are rendered homogeneous in the liquid state by addition of >20% of Mg. In the Mg-MgZn-Mg<sub>3</sub>Bi<sub>2</sub> section the reaction liquid  $A \Longrightarrow$  liquid  $B + \beta$ -Mg<sub>3</sub>Bi<sub>2</sub> occurs at 750°, 45—80% Bi, and the reaction  $\beta$ -Mg<sub>3</sub>Bi<sub>2</sub>  $\Longrightarrow$  $\alpha$ -Mg<sub>3</sub>Bi<sub>2</sub> + liquid at 677°, 20—82% Bi; the ternary eutectic point is at 339° and is almost coincident with the binary Mg-MgZn eutectic point at 340°. Bi additions do not affect the hardness of Mg-Zn alloys. A. R. P.

Mg-Mg<sub>3</sub>Al<sub>2</sub>-Mg<sub>3</sub>Bi<sub>2</sub> section of the magnesiumaluminium-bismuth system. E. SCHEIL and B. GLAUNER (Z. Metallk., 1939, **31**, 76–79).—Molten alloys of Mg, Al, and Bi are homogeneous when the Mg is >42%. In the pseudobinary section Mg<sub>3</sub>Al<sub>2</sub>-Mg<sub>3</sub>Bi<sub>2</sub> alloys with 30—75% Bi form two liquid phases from which  $\beta$ -Mg<sub>3</sub>Bi<sub>2</sub> separates at 710°; at 686° this reverts to the  $\alpha$ -form and at 453° the remaining liquid solidifies as a eutectic with 5% Bi. The ternary system contains a eutectic at 435°, Mg 88, Al 10, Bi 2%. Bi does not affect the hardness or ageing properties of Mg-Al alloys. A. R. P.

Solubility of calcium carbonate in solutions of ammonium salts. G. EMSCHWILLER and G. CHARLOT (Bull. Soc. chim., 1939, [v], 6, 1088—1100).— Previous theories are discussed and relationships are developed expressing the variation of the solubility of CaCO<sub>3</sub> with concn. of NH<sub>4</sub> salt and with  $p_{\rm H}$ . Measurements of the solubility of CaCO<sub>3</sub> in very dil. HCl and in aq. NH<sub>4</sub>Cl are in accord with the theory, and indicate that the increased solubility in presence of NH<sub>4</sub> salts is due mainly to hydrolysis and only to a much smaller extent to salt effect. J. W. S. Dissolution of orthotitanic acid in hydrogen peroxide. S. KATZOFF and R. ROSEMAN (Compt. rend., 1939, 208, 1733—1734).—Co-pptd. mixtures of  $Fe(OH)_3$  and  $Ti(OH)_4$  are sol. in  $H_2O_2$ , although  $Fe(OH)_3$  is insol.; the solutions closely resemble similar solutions of  $Ti(OH)_4$  (cf. A., 1935, 1073). Dissolution is inhibited by Ca" or Mg", and facilitated by traces of alkali. A. J. E. W.

Solubility of sucrose.-See B., 1939, 765.

(A and B) Distribution of trichloroacetic acid between water and mixed organic solvents. L. M. ANDREASOV. (C) Distribution of chloroacetic acids between contiguous liquid phases. L. M. ANDREASOV and O. T. DAVIDOVA (Trans. Inst. Chem. Charkov Univ., 1938, 4, No. 13, 107–120, 121–130, 131–136).—(A) The partition coeff. D of  $CCl_3 \cdot CO_2H$  in the systems  $H_2O-C_6H_6$ -org. solvent, at 25° and 35°, falls rapidly with rising concn. of solvent in the cases of PhNO<sub>2</sub> and *iso*- $C_5H_{11} \cdot OH$ , and very gradually in that of CHCl<sub>3</sub>. For  $C_6H_6$ -CCl<sub>4</sub> mixtures the val. of D rises with increasing [CCl<sub>4</sub>].

(B) The effect of addition of esters  $(C_5H_{11} \cdot OAc, MeOBz, EtOBz)$  is similar to that of PhNO<sub>2</sub> or  $C_5H_{11} \cdot OH$ , whilst PhBr acts similarly to CCl<sub>4</sub>.

(c) Increase in the PhNO<sub>2</sub> content of the systems  $CH_2Cl \cdot CO_2H-$  or  $CHCl_2 \cdot CO_2H-H_2O-C_6H_6-PhNO_2$  causes a fall in the val. of D. R. T.

Influence of temperature on the partition coefficient of saturated monocarboxylic acids between water and organic solvents. A. BEK-TUROV (J. Gen. Chem. Russ., 1939, 9, 419—428).— The partition coeffs. *D* have been determined for  $HCO_2H$  or AcOH between  $H_2O$  and  $C_6H_6$ ,  $CCl_4$ , or  $CHCl_3$ , at 0—60°. The vals. of *D* on the whole fall with rising temp., to a greater extent for low than for high concess. of acids. R. T.

Distribution of Br' in the system carnallitewater. S. K. TSCHIRKOV and M. S. SCHNEE (J. Appl. Chem. Russ., 1939, 12, 209—219).—The [Br'] of the solid phases of the systems  $Mg^{**}$ -Cl'-Br'-H<sub>2</sub>O (35°),  $Mg^{**}$ -K'-Cl'-Br'-H<sub>2</sub>O (35° and 45°), and  $Mg^{**}$ -Na'-Cl'-Br'-H<sub>2</sub>O (35°) rises with increasing velocity of crystallisation. The distribution coeff. of Br between MgCl<sub>2</sub> and its saturated solution is unaffected by dissolution of NaCl or KCl in the solution. R. T.

Distribution of I' between the solid and liquid phases during crystallisation of potassium and sodium bromide and potassium chloride. S. K. TSCHIRKOV and M. S. SCHNEE (J. Appl. Chem. Russ., 1939, 12, 220—225).—During isothermic evaporation at 25° of solutions of KBr or KCl containing small amounts of KI, or of NaBr with NaI, the rate of increase of the [I] of the crystal is < of the dissolved salts. R. T.

Measurement of absorption of hydrogen by wires of platinum alloys. I. E. ADADUROV and N. I. PEVNI (J. Phys. Chem. Russ., 1938, 12, 451— 454).—The wire is enclosed in a tube containing  $H_2$ under a known low pressure, and after sorption on the heated wire has occurred an electric discharge is passed through the residual gas, the pressure of which is deduced from the no. of striations in the discharge. The results show that the loss of Pt in the contact oxidation of  $NH_3$  is  $\infty$  the amount of  $H_2$  sorbed. R. C.

Active substances. XXXVIII. Study of active substances by Hahn's emanation method. R. FRICKE and H. J. BÜCKMANN (Ber., 1939, 72, [B], 1199—1206).—The increase of emanating power (E) of active substances containing radio-Th during H<sub>2</sub>O adsorption, reported by Mumbrauer (A., 1937, I, 408), is confirmed. Active MgO first adsorbs, then combines with, H<sub>2</sub>O, as shown by the initial increase and subsequent decrease of E. Compression of  $\gamma$ -Fe<sub>2</sub>O<sub>3</sub> causes a decrease of E, and the strongly compressed material shows a decrease of E during H<sub>2</sub>O adsorption, ascribed to the failure of H<sub>2</sub>O to loosen the secondary structure under these conditions. CuO quenched from 600–900° to 0° has an E slightly < that of material cooled slowly, but adsorbs H2O more strongly with a correspondingly greater rise in E. F. L. U.

Heat content of water adsorbed on cellulose.— See B., 1939, 700.

Variation of the triple point under pressure and by adsorption. E. LEDOUX (Chim. et Ind., 1939, 41, 1043—1050).—Theoretical. Since adsorbed liquid is under compression (equiv. to air pressure  $\pi$ ) owing to the adsorption forces, the triple point  $\theta_3$  lies at the point of intersection of the normal sublimation curve (the solid being unacted on by adsorption forces) and the vaporisation curve A of the liquid under an air pressure  $\pi$ . A is calc. for H<sub>2</sub>O at  $\pi = 250$  and 1000 kg. per sq. cm., the corresponding  $\theta_3$  being at  $\sim -20^{\circ}$  and  $-80^{\circ}$ . F. J. G.

Elementary composition and sorptive properties of oxidised sugar charcoals. M. DUBININ and E. ZAVERINA (J. Phys. Chem. Russ., 1938, 12, 380—396).—The reaction with atm.  $O_2$  at 200—1000° of active and inactive sugar C has been studied. Examination of the sorptive power of the C for NaOH showed that the acid substance formed in the reaction with atm.  $O_2$  at 200—600° is a surface oxide, not a separate phase, and has the properties of a weak acid. Two activation temp. optima in respect of the power of adsorbing PhOH and  $I_2$  from aq. solution were found. R. C.

Representation and interpretation of results relating to the adsorption by carbon of different classes of organic compounds, in aqueous R. AMIOT (Compt. rend., 1939, 208, solution. 1575-1577).-The Chakravarti-Dhar equation (A., 1928, 120) is applied to the adsorption of org. compounds by animal C. For monohydric alcohols, m = $1, n/\gamma = 0.16; n$  is probably 1, each alcohol mol. being adsorbed by its terminal Me group on one active adsorbent mol. k increases rapidly with the no. of C (EtOH 0.0028, BuªOH 0.0720). With polyhydric alcohols, n and k increase with the complexity of the mol. The formula does not apply accurately to acids owing to dissociation, but the  $\gamma$  vals., representing the limiting vals. of s for infinite concn. of solute, approximate to those for the analogous alcohols. With phenols, n increases with complexity, but k remains approx. const. (0.87-0.89). A. J. E. W.

Electrolyte adsorption and activity coefficient. II. Adsorption of acids by carbon from mixtures of water and organic liquids. W. OSTWALD (Kolloid-Z., 1939, 87, 284–296).—The relation  $f_x =$  $af_{c-x} + b$ , previously found to hold for the adsorption of strong aq. acids on C (cf. A., 1939, I, 366), is also valid for the adsorption of HCl and picric acid from mixtures of H<sub>2</sub>O with MeOH, EtOH, and COMe<sub>2</sub> of varying composition. The relation is no longer linear for weak acids such as AcOH. The decrease in adsorption that accompanies lowering of the  $\epsilon$  of the solution is attributed to increased interionic attraction which, by strengthening the statistical kinetic ionlattice, would oppose the redistribution of ions by adsorption. F. L. U.

Changes in sorptive properties of activated carbons with time. E. ZAVERINA and M. DUBININ (J. Phys. Chem. Russ., 1938, **12**, 397—407).—Activated C stored for 5—10 years in closed vessels was examined. C activated at 500—850° had acquired an enhanced adsorptive power for NaOH, supposedly due to formation of surface acid oxide. The adsorptive power for I<sub>2</sub> from aq. solution of C activated at 300— 500° had not changed, whilst that of C activated at higher temp. had fallen somewhat; McBain and Sessions' results (A., 1936, 809) could not be confirmed. The adsorptive power for acids in aq. solution had fallen, but that for C<sub>6</sub>H<sub>6</sub> vapour was unchanged. R. C.

Adsorption on polycrystalline bodies. E. A. NIRIFOROV (J. Phys. Chem. Russ., 1938, 12, 468— 476),—The adsorption of salts from aq. solution on polycryst. quartz is hindered or prevented by the formation on the surface of the quartz of an adsorbed layer of  $H_2O$  dipoles. Adsorption from molten salt hydrates is much more rapid than from aq. solution, suggesting that quartz adsorbs mols., not ions. The rate of adsorption increases linearly with the salt concn. R. C.

Kinetic-radioactive investigations on the active surface of crystalline powders. II. L. IMRE (Trans, Faraday Soc., 1939, 35, 751—758).—Measurements of the adsorption of Pb" on the one hand and of the rate of incorporation of Th-B on the other (cf. A., 1937, I, 299) lead to discrepant vals. of the "active" portion of the surface in the case of PbSO<sub>4</sub> suspended in  $22 \cdot 7\%$  aq. EtOH. Evidence is presented for the view that in the Th-B experiments the Paneth exchange process does not occur, and that the data represent recrystallisation only. On this basis the discrepancy is resolved and fair agreement between the two methods obtained. F. L. U.

Adsorption of acids by synthetic resins. G. BROUGHTON and Y. N. LEE (J. Physical Chem., 1939, 43, 737—741).—The rates of adsorption of  $H_2SO_4$  and HCl by  $NH_2Ph$ - and by  $m \cdot C_6H_4(NH_2)_2 CH_2O$  resins have been measured. Adsorption appears to be chemical in character and the small vals. for the equilibrium adsorption suggests that condensation occurs through  $NH_2$  groups as well as through the nucleus. W. R. A.

Sorption of water by gelatin. I. PUTILOVA (J. Phys. Chem. Russ., 1938, 12, 286-290).—Sorption of

 $H_2O$  from its mixtures with  $C_6H_6$ ,  $Et_2O$ , and  $COMe_2$ , and sorption of  $COMe_2$  from its mixtures with  $C_6H_6$ , were determined. The sorption of  $C_6H_6$  and  $Et_2O$  is immeasurably small. J. J. B.

Ageing and co-precipitation. XXVIII. Adsorption of bivalent ions on and co-precipitation with orthoferric hydroxide in ammoniacal medium. I. M. KOLTHOFF and L. C. OVERHOLSER (J. Physical Chem., 1939, 43, 767-780).—The influence of temp., temp. of formation of ortho- $Fe(OH)_3$  (I), and concn. of  $NH_3$  and of  $NH_4Cl$  on the adsorption of Mg<sup>•</sup>, Ca<sup>•</sup>, Co<sup>•</sup>, Ni<sup>•</sup>, Mn<sup>•</sup>, and Zn<sup>••</sup> on (I) and on their co-pptn. with it has been studied (cf. A., 1937, I, 457). The Freundlich adsorption isotherm is obeyed for Zn<sup>••</sup> and Ni<sup>••</sup>, Zn<sup>••</sup> being adsorbed as the aquo-ion. W. R. A.

Nature of sliding friction. J. J. BIKERMAN and E. K. RIDEAL (Phil. Mag., 1939, [vii], 27, 687—692).— Experimental data are given which indicate that as long as Amonton's law is valid, sliding friction is due not to cohesion but to the elevation of the slider over the roughnesses in the surface as Coulomb suggested. W. R. A.

Influence of films of surface-active substances on the rate of evaporation of solutions. S. I. SKLJARENKO and M. K. BARANAEV (J. Phys. Chem. Russ., 1938, 12, 271—276).—Unimol. layers of cetyl alcohol (I) reduce the rate of evaporation of HCl and of H<sub>2</sub>O from 21% and 36% HCl by 60—92%, whilst films of lauric, palmitic, and oleic acid (II) have no effect. If H<sub>2</sub> is passed over the surface of the solution the reduction of evaporation by (I) is even greater. Evaporation of CHCl<sub>3</sub> through a thick H<sub>2</sub>O layer is reduced by >90% if the H<sub>2</sub>O layer is covered by (I) or (II); this reduction presumably is due to the absence of convection currents in the surface in the presence of monolayers. J. J. B.

Deposition of protein multilayers. R. B. DEAN, O. GATTY, and E. STENHAGEN (Nature, 1939, 143, 721—722).—Factors which may invalidate the estimation of the thickness of a surface layer of protein at a given pressure from measurements on multilayers are discussed. L. S. T.

Properties of liquid layers containing few molecules. D. RĂDULESCŬ and F. RĂDULESCŬ (Kolloid-Z., 1939, 87, 241—251).—The mol. radius ( $\sigma$ ) calc. from the discontinuities in the v.p. of liquids in small capillaries or in their desorption isotherms is < that for the same liquids in bulk (cf. A., 1937, I, 458). Discussion of the packing effect in adsorbed layers or menisci of high curvature leads to the inference that  $\sigma$  for CH<sub>2</sub>PhCl should be < for C<sub>6</sub>H<sub>6</sub>, in agreement with measurements. From desorption measurements with CCl<sub>4</sub> the thickness of the layer within which close packing occurs is calc. to be 10— 15 $\sigma$ . The decrease of free energy resulting from close packing is  $\sim$ 12 g.-cal. per mol. for CCl<sub>4</sub>. F. L. U.

Parachor, desorption isotherm, and molecular radius. F. RĂDULESCŬ (Kolloid-Z., 1939, 87, 280—283).—The simple relation obtained by eliminating  $\gamma$  from the expression for [P] and the formula connecting v.p. with radius of curvature (r) of a liquid surface enables the val. of r and consequently of  $\sigma$  (mol. radius) to be calc. from desorption isotherms (cf. preceding abstract). For CH<sub>2</sub>PhCl and CCl<sub>4</sub> close agreement is found between vals. of  $\sigma$  calc. by using (a) vals. of  $\gamma$ ,  $d_{\text{Hq}}$  and  $d_{\text{vap}}$  determined by the author or taken from the literature and (b) theoretical vals. of [P]. F. L. U.

Ageing of surfaces of solutions. V. Calculation of velocity of activated concentration of dye in the surface of benzopurpurin 10B solutions. K. S. G. Doss (Kolloid-Z., 1939, 87, 272-275; cf. A., 1939, I, 195).—The velocity calc. with the help of Wheeler's theory (Trans. Nat. Inst. Sci., India, 1938, 1, 340) is, for dil. solutions (0.00025M.), of the same order of magnitude as that observed. F. L. U.

Capillary-active properties of aqueous solutions of the sodium salts of higher alkylsulphuric acids. W. KIMURA and H. TANIGUCHI (J. Soc. Chem. Ind. Japan, 1939, 42, 89-94B).—The surface  $(\gamma)$  and interfacial  $(\sigma)$  tensions towards ceresin of 0.0005-0.5% solutions of Na lauryl- (I), myristyl- (II), cetyl- (III), and stearyl- (IV) -sulphate in H<sub>2</sub>O, 2N-H<sub>2</sub>SO<sub>4</sub>, 2N-NaOH, and aq. CaCl<sub>2</sub> (100° hardness) have been determined at 40° and 60°. In aq. solutions  $\gamma$  and  $\sigma$  decrease with increasing concn. (c), but pass through a min. at a val. of c which is lowest for (IV) and highest for (I). Addition of  $H_2SO_4$  reduces  $\gamma$  and  $\sigma$  and shifts the min. to lower c. Addition of NaOH reduces  $\gamma$  considerably for (I), (II), and (III), but increases it for (IV). NaOH reduces  $\sigma$ for all the solutions, but the effect is the less the longer is the C chain. Addition of CaCl, reduces  $\gamma$  and  $\sigma$  for solutions of (I) and (II), but increases them for (III) and (IV).  $\gamma$  and  $\sigma$  for solutions of (I) are increased, but for solutions of (IV) are decreased, by rise of temp. The changes in solubility,  $\gamma$  and  $\sigma$  with increasing length of the C chain are discussed.

J. W. S. Influence of sodium sulphate on the capillaryactive properties of aqueous solutions of [sodium salts of] higher alkylsulphuric acids. W. KIMURA and H. TANIGUCHI (J. Soc. Chem. Ind. Japan, 1939, 42, 95—98B; cf. preceding abstract).—Addition of Na<sub>2</sub>SO<sub>4</sub> (0·1—0·5%) lowers the surface tension and interfacial tension towards ceresin of Na lauryl-,

Rise of liquids in capillaries. F. J. NELLEN-STEYN (Chem. Weekblad, 1939, 36, 416).—A reply to Loman (A., 1939, I, 368). S. C.

myristyl-, cetyl-, and stearyl-sulphate. J. W. S.

Dielectric potential and surface tension of certain physiologically active compounds. B. ZAPIÓR (Rocz. Chem., 1939, **19**, 323—332).—The dielectric potential-concn. curves for aq. solutions of *n*-butyl, *tert*.-amyl, and trichlorobutyl alcohol, paraldehyde, urethane, sulphonal, trional, veronal, luminal, phenacetin, *p*-aminoacetophenone, and antipyrine are parallel with the corresponding surface tension-concn. curves. R. T.

Influence of electrolytes on emulsion type and stability. A. KING and G. W. WRZESZINSKI (Trans. Faraday Soc., 1939, 35, 741—743).—50% kerosene- $H_2O$  emulsions stabilised with gum dammar, C black, agar, lecithin, bentonite, egg yolk, saponin, gum acacia, Daxad,  $Zn(OH)_2$ , and  $Al(OH)_3$  do not undergo phase reversal when treated with NaOH,  $NH_3$ , HCl,  $Al_2(SO_4)_3$ , or  $Th(SO_4)_2$ , nor is their stability affected except when the emulsifying agent is destroyed by chemical change. F. L. U.

Colloid-chemical investigations of three liquid components. III. Emulsification of two-liquid systems with equal specific gravities. N. SATA and H. OKUYAMA (Bull. Chem. Soc., Japan, 1939, 14, 147—152).—Two-liquid systems of equal sp. gr. were prepared by mixing suitable proportions of three liquids of different miscibilities and sp. gr. Emulsification and coagulation phenomena have been investigated under various conditions for the systems:  $C_6H_6-H_2O-CCl_4$ ;  $H_2O-CH_2Bu^{\beta}\cdotOH-CHCl_3$ ;  $H_2O-$ MeOH- $C_6H_6$ . W. R. A.

Mutual interaction energy of two hydrophobic colloidal particles. G. P. DUBE and S. LEVINE (Compt. rend., 1939, 208, 1812—1814; cf. A., 1939, I, 318).—An expression is derived for the interaction energy (E) of two spherical charged particles in an aq. electrolyte solution. E has a max, val. for small separations, and passes through a min. and tends asymptotically to zero as the separation increases. The max. E val., which decreases with increasing electrolyte concn. or particle diameter, probably determines the rate of coagulation. The min. val. may account for thixotropic phenomena.

A. J. E. W. Depolarisation of light traversing starch suspensions. N. CALINICENCO (Compt. rend., 1939, 208, 1807—1809; cf. A., 1939, I, 368).—The depolarisation angle ( $\alpha$ ) for starch suspensions is  $\alpha$  the diameter of the particles.  $\alpha$  decreases with rising temp., and becomes zero at 66° or 82° (with potato and rice starch, respectively), owing to disintegration of the particles.  $\alpha$  is of the same order in H<sub>2</sub>O, COMe<sub>2</sub>, PhMe, petroleum, and xylene, and is thus independent of *n*. The amylose pptd. from starch paste causes slight depolarisation, the supernatant amylopectin giving none. Depolarisation is due in each case to birefringence of the suspended particles.

A. J. E. W.

Influence of secondary scattering on depolarisation measurements. R. S. KRISHNAN (Proc. Indian Acad. Sci., 1939, 9, A, 303–308).—Measurements of the depolarisation factors in a dil. milk solution and in a PhOH–H<sub>2</sub>O mixture show that in emulsions and protein solutions the secondary scattering has a marked influence on these factors. Secondary scattering can be eliminated by illuminating with a narrow incident beam and then measuring the depolarisation factors by the Cornu method.

W. R. A. Thickness of the layers of dispersion medium in plastic suspensions of mica. M. P. VOLAROVITSCH and I. S. EROCHIN (J. Phys. Chem. Russ., 1938, 12, 277—279).—If a cylinder rotates in a mica suspension in mineral oil the viscosity of the latter decreases with time to a const. val. The "yield val." in this steady state rapidly increases with the mica concn. From these concns. the thickness of the oil layers between the mica lamellæ is calc. J. J. B. Conditions of formation of hydrosols. II. N. N. ANDREEV (J. Gen. Chem. Russ., 1939, 9, 228-232).—The stability of hydrosols of hydrocarbons, alcohols, aldehydes, acids, ketones, ethers, and other org. compounds depends on the magnitude of the dipole moment of the dispersed phase. (Cf. A., 1938, I, 310.) R. T.

Determination of degree of dispersity of leucocompounds by diffusion method. P. S. VASILIEV and N. M. DESCHALIT (J. Phys. Chem. Russ., 1938, 12, 477—478).—An apparatus for measuring rates of diffusion under anaërobic conditions is described. Measurements with leuco-compounds of indanthrene dyes point to the dispersity being approx. mol.

R. C. Cupric hydroxide sol. R. N. MITTRA (J. Indian Chem. Soc., 1939, 16, 175—182).—Data on  $\eta$ , coagulation, and ion adsorption are recorded.

F. L. U.

Formation and properties of silver bromide sol. G. H. JONKER, H. R. KRUYT, and L. S. ORNSTEIN (Proc. K. Akad. Wetensch. Amsterdam, 1939, 42, 454-460).-The conductivity, extinction cceff., [Br'], and cataphoretic velocity of 10-4-10-6M-AgBr sols (from dil. aq. KBr and AgNO<sub>3</sub>) have been measured at various periods after prep. and in presence of slight excess of AgNO3 or of KBr. The results indicate that the turbidity which develops in the sol is due to flocculation rather than to recrystallisation. Br' is adsorbed initially on the particles, but after ~20 hr. Ag' is adsorbed. All the sols examined, however, turn negative on keeping, owing to the formation of a new double layer of unknown structure. The effects of adding electrolytes are in accord with this view. J. W. S.

Colloidal impurities in distilled water. S. W. PENNYCUIK and C. E. WOOLCOCK (J. Physical Chem., 1939, 43, 681-685).—Sometimes "conductivity  $H_2O$ " contains traces of impurities which inhibit the formation of fine-grained, stable Au sols by  $CH_2O$  reduction and it is shown that some of these impurities are positively charged hydrophobic colloids. Their inhibitory action is diminished by: (a) slow freezing from the outside and subsequent thawing after <24 hr. in the solid state; (b) keeping for  $\sim 2$  weeks in Pyrex flasks; (c) redistillation; (d) addition of amounts of SnCl<sub>4</sub> as small as 1 part in 10<sup>7</sup> at  $p_{\rm m}$  between 9.7 and 10.3. W. R. A.

Dialysis in the study of colloids. V. Colloidal gold. VI. Colloidal vanadium pentoxide. B. N. DESAI, P. M. BARVE, and Y. S. PARANJPE (Proc. Roy. Soc. Edin., 1939, 59, 22—37; cf. A., 1937, I, 131).—With progressive dialysis, cataphoretic speed (v) passes through a max. in the case of  $V_2O_5$ and Au, while the conductivity ( $\kappa$ ) decreases continuously. Stability passes through a max. with Au, and decreases continuously with  $V_2O_5$ . In both cases v and  $\kappa$  decrease, and stability increases, with dilution, whilst addition of increasing amounts of univalent cations increases, then decreases, v. Bivalent ions produce a decrease in v, followed in the case of  $V_2O_5$  by an increase and then a further decrease. Ageing and exposure to sunlight cause a decrease in v,  $\kappa$ , and stability. The conception of a crit. potential is not supported. In dialysis of  $V_2O_5$ ,  $\eta$  is a min. for max. v. L. J. J.

Action of heat on concentrated solutions of titanium and of zirconium in hydrochloric acid. (MME.) H. EMMANUEL-ZAVIZZIANO (J. Chim. phys., 1939, 36, 111—116).—Solutions containing 0.6—2.5 g. of TiO<sub>2</sub> per 100 c.c. and 1.6—2N. with respect to HCl are nearly completely hydrolysed after boiling for 2 hr., about 0.03 g. of TiO<sub>2</sub> remaining in solution. Similar solutions of ZrO<sub>2</sub> are not pptd. under these conditions. With solutions containing both oxides pptn. either does not occur or is incomplete; in the latter case the ppt. contains both oxides in approx. the same proportion as the initial solution. This behaviour is explained in terms of the structure of oxide hydrosols proposed by Thomas *et al.* (cf. A., 1935, 1459). F. L. U.

Macromolecular chemistry. H. STAUDINGER (Freiburger Wissensch. Ges., 1939, No. 28, 1—32).—A lecture. F. L. U.

Macromolecular compounds. CCXV. Osmotic pressure of aqueous solutions of multivalent acids and their salts. W. KERN (Z. physikal. Chem., 1939, 184, 197—210).—Additional osmotic data on solutions of neutral and acid Na salts of a polyacrylic acid are recorded and are discussed theoretically with reference to the buffering action of cations (cf. A., 1938, I, 192). C. R. H.

Soaps and similar long-chain derivatives as simple half-strong electrolytes in dilute solution. J. W. McBAIN (J. Physical Chem., 1939, 43, 671— 679).—The recently proposed reinterpretation of colloidal electrolytes is incompatible with the thermodynamic data obtained for dil. solutions of soaps (osmotic, f.p., and lowering of v.p. data), the osmotic effects being  $\gg$  can be accounted for by colloid and simple ions. Such solutions are very similar to those of CHCl<sub>2</sub>·CO<sub>2</sub>H in which simple mols. (or neutral ion-pairs of identical formula) and ions only are present. These precede the formation of ionic micelles. At high concns. the existence of neutral micelles has been established by X-ray examination. W. R. A.

Degree of aggregation of dyes in dilute solution. I. Conductivity measurements. C. ROBINSON and H. E. GARRETT. II. Osmotic pressure measurements. C. ROBINSON and J. W. SELBY (Trans. Faraday Soc., 1939, 35, 771-780, 780-784).-I. Conductivities of Me-orange (I), Bordeaux extra (II), "meta" benzopurpurin (III), benzopurpurin 4B (IV), Congo-red (V), and the azo- (VI), disazo- (VII), and trisazo- (VIII) -dyes formed by coupling diazotised metanilic acid with successive mols. of 4-methoxy-m-toluidine, were measured at  $25^{\circ}$  over the concn. range  $8 \times 10^{-3}$ — $6 \times 10^{-6}$ N. The  $\Lambda$ — $\sqrt{c}$  plots for (I), (II), and (VI) are linear, whilst those for (III), (IV), (V), and (VII) show max. at low concns. Min. and max. aggregation nos. are calc. The mean degree of aggregation increases in the order (II) < (III) < (IV) < (V) < (VII) < (VIII).II. Osmotic pressure data for the same dyes lead

to results in qual. agreement with the above. F. L. U. Diffusion of glycogen in liquid ammonia. L. SCHMID and A. POLACZEK-WITTER (Monatsh., 1939, 72, 327—329).—Glycogen dissolved in liquid NH<sub>3</sub> does not diffuse through a cellulose membrane permeable to sucrose. L. J. J.

Rôle of micellar hydration in the effect of ultra-violet rays on agar solutions. P. PONTHUS (Compt. rend. Soc. Biol., 1939, 130, 671-672).----Ultra-violet irradiation decreases  $\eta$  when the concn. of alcohol in the dispersing phase is below 50%; above 50% there is no effect. H. G. R.

Dielectric study of the gelatin-water system : anomalous dispersion in bound (oriented) water. H. FRICKE and L. E. JACOBSON (J. Physical Chem., 1939, 43, 781—796).—The effects of gelatin concn.,  $p_{\rm H}$ , ionic strength, and structural state on the dielectric const. and dielectric absorption of gelatin-H<sub>2</sub>O systems have been determined at frequencies between 0.002 and 65.6 megacycles and field intensities between 0.5 and 5 v. per cm. Data indicate that the dielectric properties depend on a polarisation at the interfaces in the same way as for more coarsely dispersed systems. The hypothesis that the polarisation arises in the interfacial layer of oriented H<sub>2</sub>O mols. is advanced and is discussed with reference to the dielectric behaviour of hygroscopic insulators, soil, cell membranes, and metal electrodes.

W. R. A.

Dynamic birefringence (Maxwell effect) of glycerinated protein solutions. C. SADRON, A. BONOT, and H. MOSIMANN (J. Chim. phys., 1939, 36, 78—83; cf. A., 1938, I, 617).—The relations existing between the birefringence ( $\delta$ ) of solutions and the properties of their constituents make it possible to determine from measurements of  $\delta$  the coeffs. of diffusion and principal polarisabilities of the particles. Preliminary experiments with solutions of serum albumin and serum globulin (I) in 50 vol.-% aq. glycerol gave results in accord with previously established data. Total (I) in aq. glycerol behaves as a mixture of constituents having  $\delta$  of opposite signs, but in H<sub>2</sub>O as a single substance, owing to the presence of a lipin-globulin complex stable in H<sub>2</sub>O but dissociated in aq. glycerol. Extraction of lipins from (I) causes it to behave as a single substance in aq. glycerol. F. L. U.

Behaviour of inorganic ions during ultrafiltration of protein solutions containing sodium chloride. E. J. BIGWOOD and M. ERRERA (Bull. Soc. Chim. biol., 1939, 21, 737—744).—When the  $p_{\rm H}$ of protein solutions containing NaCl is near that of the isoelectric point of the protein the [Na'] and [Cl'] in the colloidal solution and its ultrafiltrate are the same. At any other  $p_{\rm H}$  the distribution of the ions is in accordance with the Donnan theory (cf. Ambard and Devillers, A., 1935, 1012). A. L.

Periodic precipitation in absence of foreign gel. II. Ferric hydroxide sol [prepared] by different methods. R. N. MITTRA (J. Indian Chem. Soc., 1939, 16, 165—174).—Further work on the formation of rings from  $Fe(OH)_3$  sols during coagulation (cf. A., 1937, I, 410) shows that the effect depends on speed of coagulation and vol. of the coagulum as well as on adsorption of the sol by the coagulum. Sols prepared by hydrolysing  $\text{FeCl}_3$  show the greatest adsorption but give no rings. F. L. U.

Coacervation. II. Osmotic pressure. (MME.) A. DOBRY (J. Chim. phys., 1939, 36, 102-110; cf. A., 1939, I, 198).—Equality of the osmotic pressures  $(\Pi)$ of coacervates and the solutions in equilibrium with them has been proved experimentally for the ternary system cellulose acetate (Î)-CHCl3-EtOH. For 2.4% of (I) the lowest vals. of  $\Pi$  occur in the range of [EtOH] corresponding with coacervation, which is therefore considered to represent the limit of dissolution. The relation between  $\Pi/[(1)]$  and [(1)] is linear, the limiting val. of  $\Pi/[(1)]$  for [(1)] = 0 being the same for all compositions of the solvent, whilst for compositions giving coacervation the real and apparent mol. wts. are the same over a wide range of [(I)]. Van der Waals' formula is not applicable to coacervated systems, which bear only a limited analogy to liquid-vapour systems. Coacervation has been observed in a binary system of CHCl<sub>3</sub> and cellulose acetate (OAc 55.9%). F. L. U.

Cataphoresis in insulating media. A. GEMANT (J. Physical Chem., 1939, 43, 743—748).—The validity of the Helmholtz equation for insulating media is theoretically discussed, and the various factors (field strength, dielectric const.,  $\eta$ , boundary potential) in insulating liquids which affect the cataphoretic velocity are considered. The cataphoresis of suitable suspensions of polystyrene in *m*-xylene-mineral oil mixtures has been investigated: (i) by obtaining visible deposits of the resin on metallic electrodes, and (ii) by a quant. microscopic examination of the motion. The data indicate an anodic motion, with the boundary potential ~30 mv. Addition of acids stabilises the suspensions, but alkali hastens coagulation by reversing the negative charge of the particles. W. R. A.

Electrophoretic properties of thymonucleic acid. E. STENHAGEN and T. TEORELL (Trans. Faraday Soc., 1939, 35, 743-750; cf. A., 1938, I, 249).-The p<sub>H</sub>mobility (v) curve for thymonucleic acid (I), measured over the range  $p_{\rm H}$  3—10, is similar to the base-binding curve in the same range, indicating that all ionisable groups are electrophoretically active. v is independent of concn. between 0.05 and 0.25% in spite of a large increase in  $\eta$  of the solution, an observation which suggests the need for caution in applying corrections based on the apparent  $\eta$  to experimental v data. v increases linearly with potential gradient between 1 and 12 v. per cm. : this effect cannot be entirely accounted for by local heating, and may be due to increased orientation of rod-shaped particles in the direction of migration. The v of mixtures of (I) with seralbumin provide evidence of interaction on the alkaline side of the isoelectric point. F. L. U.

The  $\zeta$ -potential at the boundary surface between solid and water in relation to the internal micellar and crystalline structure of the former. I. Variation of  $\zeta$ -potential of cellulose hydrate during its direct conversion into ordinary cellulose. K. KANAMARU and T. TAKADA (Z. physikal. Chem., 1939, **184**, 179–196).—The treatment of cellulose hydrate (commercial viscose silk) with  $(CH_2 \cdot OH)_2$  at 250°, as a result of which it is converted into ordinary cellulose, is accompanied by an increase in the equilibrium val. of the  $\zeta$ -potential,  $\zeta_{\infty}$ , at the solid-H<sub>2</sub>O interface.  $\zeta_{\infty}$  is more rapidly attained with the untreated than with the treated product. In both cases  $\zeta_{\infty}$  is more rapidly attained with slowly spun silks, although the differences for different rates of spinning are less noticeable with the treated product. The treatment also reduces hygroscopicity. The data are explained on the basis of Kanamaru's theory (cf. A., 1937, I, 80, 305, and subsequently). C. R. H.

Electrokinetics. XXI. Electrokinetic theory. Streaming potential and the electro-osmotic counter-effect. M. A. LAUFFER and R. A. GORTNER (J. Physical Chem., 1939, 43, 721—732; cf. A., 1938, I, 397).—The application of the Helmholtz theory to studies of the streaming potential (H) involving org. liquids is justified because H of such systems is  $\infty$ the pressure of streaming. Further, the electroosmotic counter-pressure theory has been confirmed for the systems X-cellulose (X = MeOAc, EtOAc, Pr<sup>a</sup>OAc, Bu<sup>a</sup>OAc, n-C<sub>5</sub>H<sub>11</sub>·OAc, HCO<sub>2</sub>Et, EtCO<sub>2</sub>Et, and Pr<sup>a</sup>CO<sub>2</sub>Et). The effective mean pore size of a cellulose diaphragm containing EtOAc, calc. on the basis of the back pressure theory, is 0.27  $\mu$ .

W. R. A.

Effect of addition of non-electrolytes and of temperature on times of setting of transparent inorganic gels. M. PRASAD and D. M. DESAI (J. Indian Chem. Soc., 1939, **16**, 117—126).—For the transparent gels (arsenates of Th, Sn<sup>...</sup>, Mn, Zn; phosphates of Th, Sn<sup>...</sup>, Ce; and Th molybdate) (A., 1939, I, 259), the time of setting, t, is increased, except with Mn arsenate, by addition of non-electrolytes (MeOH, EtOH, PrOH, glycerol, and C<sub>5</sub>H<sub>5</sub>N). For all, except Th arsenate, t is decreased as temp. is increased, due to an increase in agglomeration tendency and a decrease in hydration tendency. Heats of activation have been deduced from curves of log tagainst 1/T. The anomalous behaviour of Th arsenate with change of temp. and of Mn arsenate on addition of electrolytes is discussed. W. R. A.

Deformation and fine structure of hydrocellulose. VIII. Relation between anisotropy of swelling and mechanism of deformation in hydrocellulose gels. P. H. HERMANS and P. PLATZEK (Kolloid-Z., 1939, 87, 296-308).—Data recorded in Parts II and III are corr. (A., 1938, I, 79, 139). Strict comparison between experimental and calc. vals. of the anisotropy of swelling (Q) is possible only when this quantity and the extension (v) are referred to material in the unswollen state. When Q and v are thus expressed the Q-v curves are in close agreement with X-ray results for stretched dry fibres, and are compatible only with a microheterogeneous fine structure. F. L. U.

X-Ray diffraction study of the swelling action of several quaternary ammonium hydroxides on cellulose fibres. W. A. SISSON and W. R. SANER (J. Physical Chem., 1939, 43, 687—699).—On treatment with quaternary  $NH_4$  hydroxides both native and mercerised cellulose fibres (a) increase in diameter due to the swelling of inter-cryst. material, and (b) yield a new X-ray diagram attributed to the formation of a swelling compound between the reagent and the cryst. cellulose. This new diagram appears only above a sp. concn. of the hydroxide employed and is unaltered by increase in the amount of hydroxide added. Data for various hydroxides are given and discussed. The effect of heat on the X-ray patterns depends on the nature of the hydroxide. On washing with dil. acid and  $H_2O$  the complex reverts to hydrated cellulose. W. R. A.

Swelling and dissolution of casein and starch in formamide. H. ERBRING (Kolloid-Z., 1939, 87, 308—311).—Rennet-casein dissolves completely in aq. HCO·NH<sub>2</sub> (I) containing  $\leq 50\%$  of (I), and swells in more dil. mixtures. Substitution of EtOH for H<sub>2</sub>O results in diminished swelling and prevents dissolution. Acid-casein does not dissolve in pure or aq. (I), but swells to an extent increasing with concn. of (I), the initial rate of swelling being greatest for  $\sim 50\%$  of (I). Starch forms clear viscous solutions in (I), whilst in aq. (I) the transparency to light decreases regularly with decreasing concn. of (I). F. L. U.

Viscosity of aqueous solutions of strong electrolytes. IV. Viscosimetric detection of higher-order molecules in aqueous solutions. H. TOLLERT (Z. physikal. Chem., 1939, 184, 150— 158).— $\eta$  data for aq. solutions of pairs of salts indicate the existence in solution of MgCl<sub>2</sub>,KCl and (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>,2ZnSO<sub>4</sub>. No evidence of complex formation in NaCl-KCl solutions has been obtained. The conclusions support those of Spacu and Popper based on *n* data (A., 1934, 723). C. R. H.

First dissociation of carbonic acid. Y. KAUKO and H. ELO (Z. physikal. Chem., 1939, 184, 211— 230).—Vals. for the first dissociation const. of  $H_2CO_3$ and the respective methods of determination are critically examined. C. R. H.

Hydrolysis of a salt derived from a weak acid and a weak base. S. J. O'BRIEN and C. L. KENNY (J. Chem. Educ., 1939, 16, 140—142).—Except for very low salt concns., the degree of hydrolysis need not be determined separately for each ion. Data in the literature for the hydrolysis of these salts at room temp. are tabulated. L. S. T.

Specific thermodynamic properties of dilute ionic solutions. J. KIELLAND (J. Physical Chem., 1939, 43, 797—803).—Simple equations of the Debye-Hückel-Brönsted-Guggenheim type and parameters with numerical tables are given for  $\sim 100$  electrolytes at 0° and 25°. By means of these, osmotic and activity coeffs. may be computed for solutions of one or more electrolytes. The accuracy diminishes with solutions for which the ionic strength exceeds 0.1M.

W. R. A.

Activity coefficients and transport numbers of zinc bromide at 25° from e.m.f. measurements. H. N. PARTON and J. W. MITCHELL (Trans. Faraday Soc., 1939, 35, 758—765).—From the e.m.f. of cells both with and without liquid junction, activity coeffs. of  $\text{ZnBr}_2$  at 25° from 0.02 to 16M. have been calc. The standard potential of the Zn electrode is calc. to be 0.7628 v. Transport nos. of aq. ZnBr<sub>2</sub> are calc. and discussed. F. L. U. Vapour pressure of solutions saturated with potassium thiocyanate and with potassium chloride, bromide, or iodide. P. DINGEMANS (Rec. trav. chim., 1939, 58, 574-581).—The v.p. of solutions saturated with KCNS, KCNS and KCl, KCNS and KBr, and KCNS and KI have been determined between 10° and the m.p. or eutectic temp.

F. J. G.

Sucrose and liquid ammonia. I. Vapour pressure of liquid ammonia solutions of sucrose. M. AMAGASA, K. ITÔ, and K. NISHIZAWA (J. Soc. Chem. Ind. Japan, 1939, 42, 65—69в).—The v.p. temp. and v.p.-concn. relations for 40-72.5% solutions of sucrose (I) in liquid NH<sub>3</sub> are given between  $-4.95^{\circ}$ and 13.79°. The differential heats of vaporisation of the solutions, the mol. depression of v.p. (assuming Raoult's law), and the mol. association of (I) are cale. At low temp. in conc. solution (I) is apparently dissociated, probably on account of the association of NH<sub>3</sub> and the ammoniation of (I). A preliminary estimation of the v.p. of the saturated solution is given. W. A. R.

Solubility in water of cadmium perchlorate and its hydrates. H. HERING and A. LERAY (Bull. Soc. chim., 1939, [v], 6, 1034—1041).—The system  $Cd(ClO_4)_2$ -H<sub>2</sub>O has been studied between the eutectic temp. (-66.5°) and 247°. The only solid phases which occur are  $Cd(ClO_4)_2$ ,  $Cd(ClO_4)_2, 6H_2O$  (m.p. 129.4°), and the *dihydrate*, which exists in two forms, the  $\beta$ -form having congruent m.p. 157.9° and passing into the  $\alpha$ -form at <66°. No evidence was found for the existence of  $Cd(ClO_4)_2, 4H_2O$  (cf. Salvadori, A., 1912, ii, 649). J. W. S.

Two-component systems with germanium. I. Germanium-aluminium, germanium-tin, and germanium-silicon. H. STÖHR and W. KLEMM (Z. anorg. Chem., 1939, 241, 305—323).—The systems have been investigated by means of cooling curves and X-rays. Ge and Al form a cutectic at  $424^\circ$ , with 29.5 at.-% Ge (cf. B., 1927, 488). The solubility of Ge in Al rises from 0.2 at.-% at 177° to  $\sim 2.0$  at.-% at 395°. That of Al in Ge at 395° is  $\geq 3-4$  at.-%. Ge and Sn form a cutectic at 232°, with almost 100% Sn. At 195° the solubility of Ge in Sn is <0.6 at.-%, and that of Sn in Ge <1.0 at.-%. Ge and Si form a complete series of mixed crystals in which the lattice consts. are approx. additive. The types of systems formed by pairs of elements in general are discussed in the light of at. radii and position in the periodic table.

F. J. G.

Melting lines of potassium thiocyanate with potassium chloride, bromide, and iodide. P. DINGEMANS (Rec. trav. chim., 1939, 58, 559–573).— The m.p. of KCNS is 176.6°. The systems KCNS– KCl, KCNS–KBr, and KCNS–KI are of the simple eutectic type, the respective eutectic temp. being  $172.5^{\circ}$ ,  $170.2^{\circ}$ , and  $168.0^{\circ}$ , and the compositions  $2.45^{\circ}_{\circ}$  KCl,  $5.90^{\circ}_{\circ}$  KBr, and  $10.7^{\circ}_{\circ}$  KI. The curves from the m.p. of KCNS to the eutectics are straight lines, from which the heat of fusion of KCNS is calc. to be 3130, 3185, and 3035 kg.-cal. per g.-mol.

F. J. G. Binary system phenylhydrazine-p-chlorophenol. N. A. PUSHIN and G. M. DIMITRIJEVIĆ (Z. physikal. Chem., 1939, 184, 231–237).—From cryoscopic data for mixtures of NHPh·NH<sub>2</sub> (A) and p-C<sub>6</sub>H<sub>4</sub>Cl·OH (B), the existence of 2A,B, A,B, and A,3B has been demonstrated. A fourth complex of uncertain composition is also indicated. B exists in two modifications. If liquid B is supercooled to  $<34^{\circ}$  $\beta$ -B crystallises. It is metastable at room temp. and atm. pressure and gradually changes to  $\alpha$ -B.

C. R. H.

Nickel sulphate and cobalt sulphate. R. ROHMER (Ann. Chim., 1939, [xi], 11, 611—721).—A detailed account of work already noted (A., 1934, 255, 1187; 1935, 1461; 1938, I, 412) is given, and equilibrium data are recorded for the system  $NiSO_4$ —CoSO<sub>4</sub>— H<sub>2</sub>O between 0° and 61°. The solid phases are always mixed crystals, of which there are in all four series, viz., monoclinic and orthorhombic heptahydrated, monoclinic and quadratic hexahydrated. F. J. G.

Reversible pairs of salts.—See B., 1939, 716.

Physico-chemical analysis by determination of eutexy lines. E. CORNEC and M. LEHNÉ (Compt. rend., 1939, 208, 1816-1818).-The method consists in determining the temp.  $(\theta_s)$  at which a solution of two salts commences to deposit solid salt in addition to ice.  $\theta_s$  (determined experimentally with rising temp.) depends only on the relative proportions of the salts present. A plot of  $\theta_s$  against the composition of the salt mixture shows a ternary eutexy point with K2SO4, KNO<sub>3</sub>, and ice; NiSO<sub>4</sub>,7H<sub>2</sub>O-ZnSO<sub>4</sub>,7H<sub>2</sub>O and KCl-KBr give continuous series of mixed crystals, the curve for the latter containing a min.  $MgSO_4$  and  $(NH_4)_2SO_4$  give congruent  $(NH_4)_2SO_4,MgSO_4,6H_2O$ ; the corresponding K salt is incongruent at the eutexy temp. MgSO<sub>4</sub> hydrates with 11, 9, and 7H<sub>2</sub>O give different eutectic temp.  $(-3.9^{\circ}, -4.9^{\circ}, -5.2^{\circ})$  with ice. A. J. E. W.

Systems alkali oxide-CaO-Al<sub>2</sub>O<sub>3</sub>-SiO<sub>2</sub>-CO<sub>2</sub>. VIII. Reaction pressures of quartz and disilicate with alkali double carbonates. C. KRÖGER and K. W. ILLNER (Z. anorg. Chem., 1939, 241, 338-348; cf. A., 1935, 935, 1323).-When KNaCO<sub>3</sub> (I) is heated with  $SiO_2$  the pressures for 25-55% reaction correspond with those obtained for K<sub>2</sub>CO<sub>3</sub> or Na<sub>2</sub>CO<sub>3</sub>, but higher pressures are obtained for  $<\!25\%$  reaction. These correspond with the formation of an alkali oxide-SiO, solid solution as a result of greater mobility in the lattice, corresponding with the lower m.p. of the double carbonate. With  $2(I) + Na_{2}Si_{2}O_{5}$  the pressures obtained correspond with those obtained for the corresponding equilibrium in the system Na<sub>2</sub>O-SiO<sub>2</sub>-CO<sub>2</sub>, so that Na<sub>2</sub>SiO<sub>3</sub> and K<sub>2</sub>CO<sub>3</sub> are the products. With Na2Si2O5 in excess the pressures are in the same range, the products being K2Si2O5 and Na2SiO3. With LiNaCO<sub>3</sub> and SiO<sub>2</sub> analogous results are obtained. In neither case does the use of the double carbonate cause an appreciable acceleration of the reaction.

F. J. G.

International temperature scale and some related physical constants. H. T. WENSEL (J. Res. Nat. Bur. Stand., 1939, 22, 375–395).—With a view of defining a temp. scale above  $1063^{\circ}$  in as close correspondence as possible with the thermodynamic scale, the vals. of  $c_2$  in Planck's radiation formula, and of a no. of related consts., are reviewed. F. J. G.

Heat and free energy of formation of water and of carbon monoxide. F. D. ROSSINI (J. Res. Nat. Bur. Stand., 1939, 22, 407—414).—Calorimetric and thermodynamic data are combined to give vals. for the heat and free energy of formation of  $H_2O$  and CO, and for the water-gas and producer-gas reactions, each substance being in the thermodynamic standard state. F. J. G.

Effective molecular heats and their use in calculation of combustion temperatures. G. RIBAUD (Arch. Wärmewirts., 1939, 20, 72–74).—The effective mol. heats of  $CO_2$  in  $CO_2 + nN_2$ ,  $CO_2 + 0.2O_2 + nN_2$ , and  $CO_2 + 0.4O_2 + nN_2$ , of  $H_2O$  in  $H_2O + nN_2$  (n = 2, 4, 8, 12, and 16) over the range 1300—2700°, and the heats of combustion of CO and  $CH_4$  in air, are tabulated. The application of the data to the determination of the combustion temp. of various mixtures is illustrated by examples. R. B. C.

New method of calculating combustion temperatures and its application to mixtures of alcohol vapour, water vapour, and oxygen. Calculation of enthalpy, entropy, heat capacity, and reduced thermodynamic potential of ethyl alcohol vapour. H. ZEISE (Z. Elektrochem., 1939, 45, 456—463, cf. B., 1938, 1005).—Thermodynamic consts. of steam and EtOH vapour and vals. of the equilibrium const. for the reaction EtOH +  $H_2O = 2CO + 4H_2$  from 400° to 1400° have been calc. theoretically from thermochemical and spectroscopic data. J. A. K.

Heats of combustion of tetramethylmethane and  $\beta$ -methylbutane. J. W. KNOWLTON and F. D. ROSSINI (J. Res. Nat. Bur. Stand., 1939, **22**, 415– 424).—The heats of combustion in O<sub>2</sub> at 25° and 1 atm. of gaseous CMe<sub>4</sub> and CHMe<sub>2</sub>Et to gaseous CO<sub>2</sub> and liquid H<sub>2</sub>O are 840.61±0.23 and 843.36±0.15 kg.-cal. per g.-mol., respectively. F. J. G.

Thermochemistry of paraffins and aliphatic alcohols. H. C. BLANCK (Z. physikal. Chem., 1939, 43, B, 153—172).—Theoretical. Considerations based on variations in the heat of combustion caused by introducing substituents into paraffins and aliphatic alcohols enable a quant. definition of valency energy to be made. Intramol. reciprocal effects are discussed and semi-empirical calculations of their vals. have been made. C. R. H.

Formation and decomposition of ozonides considered from the point of view of energy. E. BRINER (Helv. Chim. Acta, 1939, 22, 591-600).— The heats of ozonisation of various org. compounds indicate that the decomp. of ozonides, either into two residues or with complete disruption of the mol., is strongly exothermic. The two modes of decomp. therefore always occur simultaneously, the relative yields of each process being determined by the nature of the ozonide and its solvent and temp. J. W. S.

Free energy and heat of formation of cuprous sulphide from electromotive force measurements. A. F. KAPUSTINSKI and I. A. MAKOLKIN (J. Phys. Chem. Russ., 1938, **12**, 361—370).—From measurements with the cell  $Pt|H_2$  (*P* atm.)|HCl (*X*M.)||HCl (*X*M.)|H<sub>2</sub>S (*P* atm.)|Cu<sub>2</sub>S ( $\alpha$ ) at 15—35° the free energy of formation of Cu<sub>2</sub>S,  $\Delta G_{298}$ , has been found to be -19,220 and the heat of formation,  $\Delta H_{298}^{*}$ , to be -18,500 g.-cal. R. C.

Electrochemical determination of free energies and heats of formation of lead and stannous sulphides. A. F. KAPUSTINSKI and I. A. MAKOLKIN (J. Phys. Chem. Russ., 1938, **12**, 371–379).—From e.m.f. measurements with the cells  $Pt|H_2$  (*P* atm.)] HCl (*XM*.)||HCl (*XM*.)|H<sub>2</sub>S (*P* atm.)]PbS or SnS at 15—35°, the vals. of  $\Delta G_{298}^{\circ}$  and  $\Delta H_{298}^{\circ}$  for the reaction Pb + S (rhombic) = PbS have been found to be -20,993 and -22,490 g.-cal., respectively, the corresponding vals. for the reaction Sn + S (rhombic) = SnS being -19,680 and -18,180 g.-cal., respectively. The solubility product of SnS is 1 × 10<sup>-27</sup>. R. C.

Progressive breakdown in a conducting liquid. L. B. SNODDY and J. W. BEAMS (Physical Rev., 1939, [ii], **55**, 879).—In an investigation of a comparatively slow type of liquid breakdown, observations on a discharge ( $\sim$ 10 kv. per cm. max.) between Cu electrodes under the surface of a CuSO<sub>4</sub> solution in a special cell are reported. Photographs show a marked resemblance to electrical figures observed under insulating liquids. N. M. B.

Conductometric study of solutions containing citrate and ferric ions, in presence and absence of hydrogen peroxide. M. M. BOBTELSKY and A. E. SIMCHEN (Compt. rend., 1939, 208, 1646—1647).— The conductivity ( $\kappa$ ) data indicate the occurrence of the following equilibria (X = C<sub>6</sub>H<sub>5</sub>O<sub>7</sub>'') : 2[Fe<sub>3</sub>X<sub>2</sub>]''' + 5X  $\Longrightarrow$  3[Fe<sub>2</sub>X<sub>3</sub>]'''; 2[Fe<sub>2</sub>X<sub>3</sub>]''' + 5Fe'''  $\rightleftharpoons$ 3[Fe<sub>3</sub>X<sub>2</sub>]'''. Formation of [Fe<sub>3</sub>X<sub>2</sub>]''' by the second reaction is facilitated in presence of H<sub>2</sub>O<sub>2</sub>, with which it forms an unstable intermediate product giving rise to the decomp. reaction (cf. A., 1939, I, 423).  $\kappa$  is const. during the induction period, but rises rapidly during decomp.; the difference between the initial and final  $\kappa$  vals. is max. and zero with Fe'''/X = 3/2 and 2/3, respectively, the [Fe<sub>3</sub>X<sub>2</sub>]''' ion undergoing some change during the reaction. Further quantities of H<sub>2</sub>O<sub>2</sub> are decomposed immediately on addition, the initial and final  $\kappa$  vals. being identical.

#### A. J. E. W.

Electrolytic migration of gold in solid leadgold alloys. K. E. SCHWARZ and R. STOCKERT (Z. Elektrochem., 1939, 45, 464—466).—Pb wires containing 0.04% Au were subjected to a current of about 2000 amp. per sq. cm. at a field strength of 0.1 v. per cm. and afterwards cut into sections and the Au content determined. The results showed migration of Au to the anode and determinations of the transport no. at three temp. were in agreement with vals. calc. from the diffusion const. of Au in Pb if the valency was taken as zero. J. A. K.

Transport of water to anode or cathode through non-aqueous liquids. C. C. RAINEY (Science, 1939, 89, 435–436).—When equal portions of an aq. salt solution are separated in a U-tube by a non-aq. liquid, and Pt electrodes dipping into the aq. solutions are connected to a supply of d.c.,  $H_2O$  is transported to the anolyte or catholyte. With  $(NH_4)_2C_2O_4$  or  $Na_2C_2O_4$  as electrolyte and PhCHO or  $CCl_4$  as membrane,  $H_2O$  is transported to the cathode; with  $Cu(NO_3)_2$ , it goes to the anode. At 110 v. transport is very slow, but at 450-500 v. a difference in vol. of the analyte or catholyte is noticeable in 2 days. These effects appear to be due not simply to electroendosmosis, but to movement of hydrated ions.  $NH_4^+$  appears to have a high degree of hydration. L. S. T.

Potential of lead-cadmium alloys. B. G. PETRENKO, E. E. TSCHERKASCHIN, and E. V. ERMO-LAEVA (Trans. Inst. Chem. Charkov Univ., 1938, 4, No. 13, 57—63).—The solid solubility of Cd in Pb is 5%, as determined from the p.d. between Cd-Pb anodes and a Cd cathode in  $\mathbb{N}$ -CdSO<sub>4</sub>. Anomalous behaviour of alloys containing 8-15% Cd is ascribed to formation of a protective film of PbSO<sub>4</sub> on the Cd crystals, as a result of which the anode behaves as a homogeneous alloy; this effect is nearly absent in alloys subjected to prolonged heating at 200°, and containing large Cd crystals. R. T.

So-called "oil potentials." G. C. H. EHRENS-VÄRD and L. G. SILLÉN (Z. Elektrochem., 1939, 45, 440-456).-The origin of potentials set up at the interface between an oil and an aq. electrolyte is discussed from the points of view of the partition and the adsorption theories. Apparatus for measuring the e.m.f. of cells of the type electrolyte (concn. 1) oil|electrolyte (concn. 2) is described, and results are recorded for aq. KCl with PhNO<sub>2</sub>, PhCl, COPhMe, and for various mixtures. Similar measurements with aq. methylene-blue gave results in agreement with those calc. from adsorption data by use of activities derived from f.p. depressions. Freshly distilled "oils" showed an ageing effect during the measurements. J. A. K.

**Overvoltage of silver.** A. T. VAHRAMIAN (Compt. rend. Acad. Sci. U.R.S.S., 1939, 22, 238—241).— Discrepancies in the recorded data for the overvoltage of Ag are discussed in terms of the changes that occur in the active cathode surface and c.d. during electrolysis. There is no direct relationship between the val. of the polarisation and the apparent c.d., and the relationship cannot be established unless c.d. is referred to the active surface of the growing crystal and not to the total cathode surface. L. S. T.

Influence of surface-active substances and colloids on the overpotential of cadmium and lead. S. F. BILETZKI, E. K. OVETSOHKIN, and I. M. FRANZEVITSCH (Trans. Inst. Chem. Charkov Univ., 1938, 4, No. 13, 23—48).—Changes in cathode overpotential during electrolysis of  $0.5\text{N-CdSO}_4$  in  $0.1\text{N-H}_2\text{SO}_4$  at  $0.-55^\circ$  (c.d. 0.0015—8 ma. per sq. cm.), in presence of 0-1% of gelatin, 0.001-0.07M-o-cresol, or 0.001-0.05M-p-toluidine are recorded. Similar data are given for electrolysis of N-Pb(OAc)<sub>2</sub> in N-AcOH, at 25° (c.d. 0.00055—3 ma.), in presence of 0.001-0.25% of gelatin. The most adherent deposits of Cd are obtained in presence of >0.01% of gelatin, at 35°. Dense, finely cryst. deposits are obtained in presence of 0.001M-o-cresol or -p-toluidine. R. T.

Determination of small concentrations of electrolytes by measurement of the strength of the current in closed circuits. I, II. B. A. RASCH-KOVAN (J. Gen. Chem. Russ., 1939, 9, 203-212, 213—220).—I. The deflexion y of a galvanometer needle in circuit with Hg and Hg-Cu electrodes n cm. apart in aq. solutions of concn. x, at 30°, is expressed by the empirical equation log y(b + n) = $a \log x + C$ , where a, b, and C are consts. The concn. of 0.0001—0.0005N-AgNO<sub>3</sub> is thus determined, with an error > +5%.

with an error > +5%. II. The current developed in the above conditions in solutions containing AgNO<sub>3</sub> and an equiv. concn. of K, Na, NH<sub>4</sub>, Ca, Sr, Ba, Zn, Co, Ni, or Al nitrates is equal to that which would have been found were the NO<sub>3</sub>' combined with Ag alone. The concn. of the enumerated nitrates may be determined from the difference between the val. of y for the AgNO<sub>3</sub> alone and together with other nitrates. The method is not applicable to Fe and Cu nitrates. R. T.

Theory of many-electrode electrochemical systems and its application to corrosion problems. III. Many-electrode galvanic systems. N. D. TOMASCHOV (J. Phys. Chem. Russ., 1938, 12, 414-426) .- The investigation previously described (A., 1938, I, 34) has been extended to include systems of 4 and 5 electrodes. In many-electrode systems inclusion of a new electrode as cathode increases the activity of all the anodes and diminishes that of the cathodes, whilst inclusion of a new anode increases the activity of the cathodes and diminishes that of the anodes. The difference effect (cf. A., 1936, 1474) and the action of protectors both seem to depend on diminution in the activity of local elements on the surface of the metal, as a result of diminished activity of the local cathodes in the first case, and lessened activity of the local anodes in the second. R. C.

Pyrolysis of disilane and trisilane. H. J. EMELÉUS and C. REID (J.C.S., 1939, 1021-1030).-The kinetics of the decomp. of Si<sub>2</sub>H<sub>6</sub> and Si<sub>3</sub>H<sub>8</sub> have been studied in Si-coated glass bulbs at 314-360° and 303-350°, respectively. The products are SiH<sub>4</sub>, H<sub>2</sub>, Si, and small amounts of a solid hydride, probably  $(SiH_2)_x$ . The increase of pressure is closely parallel to the % decomp. and may be used to follow the reaction. After a short induction period the reactions are approx. unimol., and obey the Arrhenius equation with E = 51,300 and 43,000 g.-cal. respectively. Addition of H<sub>2</sub> eliminates the induction period, slightly retards the later stages of the reaction, and increases the yield of SiH4. Packing the tube causes a slight retardation. When the reactions are carried out in presence of  $C_2H_4$ , this is polymerised, and some  $C_2H_6$  is produced. The decomp. of one mol. of  $Si_2H_6$  or  $Si_3H_8$  produces polymerisation of approx. 1.0 or 1.3 mols. of  $C_2H_4$ , respectively. These results indicate that the reactions are chain reactions involving SiH<sub>3</sub> radicals. F. J. G.

Kinetics of oxidation of methane. II. Terminal products. W. STARONKA and L. CZERSKI (Rocz. Chem., 1939, **19**, 333—346; cf. A., 1939, I, 326).— Oxidation of CH<sub>4</sub> involves the reactions CH<sub>4</sub>  $\rightarrow$  CH<sub>2</sub>O  $\rightarrow$  CO  $\rightarrow$  CO<sub>2</sub>; MeOH is formed in small amounts, probably from CO or CH<sub>2</sub>O. R. T.

Reactivity of lower hydrocarbons. X, XI. Reactions between atomic deuterium and saturated aliphatic hydrocarbons. K. MORIKAWA (J. Soc. Chem. Ind. Japan, 1939, 42, 139–142B, 142–145B; cf. A., 1939, I, 425).—X. No exchange occurs between 25° and 208° between  $CH_4$  and  $D_2$  but at 310° 10% exchange is found.  $C_2H_6$  is decomposed by  $D_2$  above 27°, but exchange occurs only above 100°. The most important fact about reactions between  $C_3H_8$  or  $C_4H_{10}$  and  $D_2$  is that comparatively little  $CH_4$  is formed but that this small amount is highly substituted by D.

XI. Reaction mechanisms and bond energies are discussed, and the catalytic reactions are compared with the homogeneous reactions involving free radicals. T. H. G.

Kinetics of decomposition reactions of the lower paraffins. IV. Rôle of free radicals in decomposition of *n*-butane. E. W. R. STEACIE and H. O. FOLKINS (Canad. J. Res., 1939, **17**, B, 105— 120).—The efficiency of NO in suppressing chains initiated in *n*-C<sub>4</sub>H<sub>10</sub> at low temp. by means of  $(CH_2)_2O$ has been investigated. NO is not completely efficient since sensitisation by  $(CH_2)_2O$  persists in presence of large amounts of NO. It is concluded that max. inhibition of org. decomp. reactions by NO does not in all cases correspond with complete suppression of chains, and hence the real chain length may be > that inferred from the results of the NO inhibition method. D. F. R.

Excitation of chain polymerisation by free radicals. G. V. SCHULZ and G. WITTIG (Naturwiss., 1939, 27, 387-388).-Free radicals produced by thermal decomp. of metal alkyls can induce polymerisation of unsaturated compounds. The effect of free radicals existing in equilibrium in solution on polymerisation has now been investigated. The effect of the addition of tetraphenylsuccinodinitrile (I), which decomposes reversibly into two radicals CPh<sub>2</sub>(CN), to styrene at 100° has been examined. The polymerisation is accelerated. The mol. wt. of the product after being kept for 2 hr. with various concns. of (I) was determined. The no. of additional mols. of the polymerides produced increased  $\propto \sqrt{[\text{concn. of (I)}]}$ , so that the velocity of the primary effect by which the reaction chain is set in progress is  $\propto$  concn. of free radical. Control experiments indicate that the nitrile itself is ineffective. The acceleration ceases after about 1 hr. but (I) continues to be used up in an addition reaction. A. J. M.

Explosibility of gases produced by [coal-] mine fires.—See B., 1939, 681.

Modified form of "life period" method applied to reaction of sodium vapour with bromobenzene. E. WARHURST (Trans. Faraday Soc., 1939, 35, 674—680).—Using the modified method described by Fairbrother and Tuck (A., 1936, 537), the experimental conditions for obtaining trustworthy vals. of the velocity coeff. k for the reaction Na + PhBr = Ph + NaBr have been established. The mean val. of k is  $2 \cdot 0 \times 10^{12}$  at  $255^{\circ}$  and  $3 \cdot 1 \times 10^{12}$  at  $330^{\circ}$ . The activation energy is  $3 \cdot 8k$ g.-cal. per mol., and the collision cross-section  $5 \cdot 1 \times 10^{-16}$  sq. cm. Saturation of the carrier gas with Na vapour was proved experimentally. F. L. U. Kinetics of the decomposition of acetaldehydeammonia in aqueous acid solution, and some notes on the aldines. D. T. LEWIS (J.C.S., 1939, 968—972).—When acetaldehyde-ammonia (I) reacts with aq. HCl some of the HCl is neutralised instantly, the rest by a slow reaction which follows the unimol. law. If (I) is kept in aq. solution for a time before treatment with HCl the amount instantly neutralised increases. It is concluded that (I) exists in two forms in solution, an unstable form which reacts instantly with HCl, and a stable form, the transformation of which into the unstable form is the measured reaction. The compounds (CHMe:NH)<sub>n</sub>, m.p. 85°, and MeCHO,NH<sub>4</sub>Cl are described. F. J. G.

Velocity of formation of oximes in presence of buffers. P. ANZIANI (Bull. Soc. chim., 1939, [v], 6, 949—954; cf. A., 1938, II, 101).—The velocity (v) of formation of oximes from COPhMe, COPhPr<sup>a</sup>, and COPhPr<sup>β</sup> has been studied in buffer solutions of  $p_{\rm H}$  2—10·7. Min. v is observed at  $p_{\rm H}$  8·7—9·7, but the nature of the buffer solution affects the velocity, especially at  $p_{\rm H}$  5·2—5·3. At each  $p_{\rm H}$  the vals. of v for the three ketones are in approx. const. ratio, the steric effect of Pr<sup>β</sup> being always > that of Pr<sup>a</sup>.

J. W. S.

Velocity of formation of semicarbazones and of phenylhydrazones. P. ANZIANI (Bull. Soc. chim., 1939, [v], 6, 954—957).—The velocities of reaction of NH<sub>2</sub>·CO·NH·NH<sub>2</sub>,HCl (I) and NHPh·NH<sub>2</sub>,HCl (2 mols.) with  $C_6H_{13}$ ·CHO, cyclohexanone, and COPhMe (1 mol.) and of (I) with piperonal and COPhPr<sup>a</sup> have been studied at 0° in 50% aq. EtOH in presence of various concurs. of NaOH. The results indicate that, like oximes (cf. preceding abstract), semicarbazones and phenylhydrazones are more easily produced with the hydrochlorides than with the free bases. In each case optimum conditions for reaction occur in presence of 2 mols. of the hydrochloride, 1·2 mols. of NaOH, and 1 mol. of the aldehyde or ketone. J. W. S.

Kinetics of reactions in which solids participate. II, III. Kinetics of the reduction of iron nitrides by hydrogen. B. EROFEEV, N. I. KOBOSEV, A. BOGOJAVLENSKAJA, and K. PROSKURNINA (J. Phys. Chem. Russ., 1938, 12, 188—205, 206—226).—II. Reduction of Fe nitrides of a composition varying between Fe<sub>2.03</sub>N and Fe<sub>4.15</sub>N and partly containing Al<sub>2</sub>O<sub>3</sub>, K<sub>2</sub>O, or Fe<sub>3</sub>O<sub>3</sub> was measured between 220° and 300°. The rate showed a max. which was attained the more rapidly the higher was the temp. Deposition of Fe from Fe(CO)<sub>5</sub> on to the nitride increased the rate and caused the disappearance of the max. From the change of the reaction velocity with time the mechanism of the reaction was deduced; the majority of the hydrogenations started on crystal edges, some on crystal corners, and one on crystal faces.

III. From the above data the activity of the primary reaction centres and the rate of expansion of the reaction into the bulk of crystals were cale.

J. J. B. Kinetics of topochemical reactions. S. Z. ROGINSKI (J. Phys. Chem. Russ., 1938, 12, 427– 444; cf. A., 1938, 529).—Taking account of the discontinuity of crystal growth, new reaction velocity equations have been deduced, and criteria established for crystallisation and chemical effects in topochemical reactions. For many of the topochemical reactions so far studied the energy of activation, E, is approx. zero. The larger is E, the more important is the rôle of chemical factors. Data for the decomp. of solid permanganates show the importance of the deforming power of the cation in the topochemical decomp. of salts of complex acids. R. C.

Rate of crystallisation as a criterion of purity of organic compounds. J. MICHEL (Bull. Soc. chim. Belg., 1939, 48, 105–157).—The rate of crystal-lisation of a supercooled liquid on seeding  $\propto$  the nature of the substance and is useful for the identification and determination of purity of org. compounds and for the differentiation of polymorphic forms. Ultrafiltration merely increases the extent to which supercooling is possible. Of 57 substances examined, 36 gave reproducible results. Impurities reduce the rate, the influence being greatest at a temp. corresponding with max. rate of crystallisation of the pure substance. The presence of >20% of impurity increases the no. of centres of crystallisation on seeding. Difficulties are encountered with mixtures of isomorphous substances. The influence of constitution is discussed; the more symmetrical is the mol. the greater is the rate of crystallisation.

F. H. Influence of high pressures on propagation of reactions in explosive solids.—See B., 1939, 782.

Combustion of explosives.—See B., 1939, 781.

Rate of propagation of combustion in a bomb. —See B., 1939, 685.

Determination of catalytic effect of traces of substances. P. G. POPOV (Trans. Inst. Chem. Charkov Univ., 1938, 4, No. 13, 145–158).—MnSO<sub>4</sub> and  $K_2S_2O_8$  yield purple KMnO<sub>4</sub> solution in presence, and brown MnO<sub>2</sub> suspension in absence, of traces of Ag. R. T.

Catalytic decomposition of hydrogen peroxide in presence of ferric citrate. M. M. BOBTELSKY and B. KIRSON (Compt. rend., 1939, 208, 1577—1579).— The decomp. of  $H_2O_2$  (followed by  $O_2$  evolution) in presence of  $Fe_2(SO_4)_3$  and Na citrate (I) is studied. With  $[Fe^{\dots}]/[C_6H_5O_7^{\dots}] = 5$ —10, (I) enhances the catalytic effect of Fe<sup>\dots</sup>, decomp. occurring rapidly without an induction period. Higher (I) concns. retard decomp. and cause marked induction periods, which are greater in the absence of light. A. J. E. W.

Catalytic properties of sulphuric acid and sulphates. I. Hydrolysis of ethyl acetate in presence of sulphuric acid. W. WYCZAŁKOWSKA (Rocz. Chem., 1939, 19, 347—354).—The velocity coeff, of the reaction of hydrolysis of EtOAc in presence of  $H_2SO_4$  agrees with that calc. on the assumption that the catalyst is H', and that  $H_2SO_4$ is totally dissociated. The lower vals. obtained with HCl or HClO<sub>4</sub>, which are also completely dissociated, do not invalidate this view, the result being ascribed to the retarding effect of Cl' or ClO<sub>4</sub>'. R. T.

Lecture demonstration of catalysis in homogeneous and heterogeneous systems. A. KRAUSE (Rocz. Chem., 1939, **19**, 365–370).—The catalytic action of Fe<sup>...</sup>, FeO(OH)<sub>2</sub>, Cu<sup>..</sup>, Cu(OH)<sub>2</sub>, Co<sup>..</sup>, or Co(OH)<sub>2</sub> is demonstrated by the reaction between indigo-carmine and  $H_2O_2$ . R. T.

Surface-active substances in contact catalysis. V. BERTLEFF (Chem.-Ztg., 1939, 63, 409-412, 441-442).—A review.

Relation between catalytic activity and size of particle. E. W. THIELE (Ind. Eng. Chem., 1939, 31, 916—920).—Mathematical. For any given grain size of a porous catalyst the ratio (actual activity)/ (activity corresponding with infinitely small grain size) is determined by a dimensionless modulus, vals. of which are compared for cases in which the catalyst is in spheres or flat plates, and the reaction is of first or second order and involves no vol. change or an increase or decrease of vol. F. L. U.

Kinetics of reactions in which solids participate. IV. Thermal decomposition of mercuric oxide. B. V. EROFEEV and K. I. TRUSOVA (J. Phys. Chem. Russ., 1938, 12, 346—360; cf. A., 1939, I, 423).—The decomp. at 400—500° is autocatalysed by the Hg formed, apparently through this being adsorbed on the surface of the HgO and creating a configuration facilitating reaction; Hg added to the system has no catalytic action. Different samples of Hg vary considerably in reactivity. Reaction starts on the edges of the crystals, but is often complicated by sintering. The energy of activation of the decomp. is 57,500 g.-cal. R. C.

Catalysts for synthesis of liquid hydrocarbons from carbon monoxide and hydrogen. IV. Catalysts prepared by the roasting method. S. TSUTSUMI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, 36, 47-52) .- Co catalysts with ThO2, U<sub>3</sub>O<sub>8</sub>, or MnO as promoter have been prepared by mixing the nitrate solutions with kieselguhr, evaporating, and roasting below 300°. After reduction with H<sub>2</sub> the rate of contraction of a mixture of CO and H<sub>2</sub> was measured by passing it over the heated catalyst. The optimum reduction temp. of these catalysts is lower than for those prepared by pptn., but they are not so active unless a large amount of kieselguhr is added. The differences between catalysts prepared by roasting and by pptn. is the smaller the larger is the mol. wt. of the promoter. (Cf. B., 1939, 803.) T. H. G.

[Catalytic] synthesis of benzine from carbon monoxide and hydrogen under ordinary pressure. —See B., 1939, 688.

[Catalytic] conversion of carbon monoxide under increased pressure [with steam].—See B., 1939, 685.

Effect of support on sintering of catalysts. I. E. ADADUROV and N. A. PROZOROVSKI (J. Phys. Chem. Russ., 1938, 12, 445—450).—Examination of the hydrogenation of  $C_2H_4$  catalysed by Ni supported on sulphates of bivalent metals has shown that the greater is the radius of the cation of the support the smaller is the tendency of the catalyst to sintering and the greater is its activity. With an oxide of a quadrivalent metal as support, the activity is greater and the tendency to sintering smaller than with a sulphate of a bivalent metal as support.  $SnO_2$  and  $MgSO_4$  both produce the max. tendency to sintering and the min. activity. R. C.

Copper as catalyst for hydrogenation of benzene.—See B., 1939, 689.

Catalytic activity of intermetallic compounds in the gas-phase reduction of nitrobenzene. O. W. BROWN, J. E. BORLAND, R. A. JOHNSTON, and R. C. GRILLS (J. Physical Chem., 1939, 43, 805—807).—The vapour-phase reduction of PhNO<sub>2</sub> to (:NPh)<sub>2</sub> and NH<sub>2</sub>Ph in the presence of Tl<sub>2</sub>Pb and of Tl<sub>3</sub>Bi has been investigated. The effect of various additions of one metal to the compound is studied. Tl<sub>2</sub>Pb behaves more like Pb than like Tl; Tl<sub>3</sub>Bi is less active than either Tl or Bi. W. R. A.

Effect of internal field and polarisability of molecule on energy of activation. I. E. ADADUROV and E. G. SEDASHEVA (J. Phys. Chem. Russ., 1938, 12, 455–459).—Examination of the rate of catalysed hydrogenation of o- and p-C<sub>6</sub>H<sub>4</sub>Me·NO<sub>2</sub> in the vapour phase has shown that the larger is the Kerr const. of the substrate the smaller is the energy of activation. R. C.

Cathode phenomena in the electrolysis of aqueous solutions of alkali salts or hydroxides. R. PIONTELLI (Gazzetta, 1939, 69, 221—237).—The mechanism of the cathode discharge process during the electrolysis of solutions of Na<sup>•</sup> ions is discussed. The direct discharge of Na<sup>•</sup> ions probably occurs only at Hg and Pb cathodes. In general, the primary process consists in the loss of H by a hydrated Na<sup>•</sup> ion present in the cathode double layer. O. J. W.

Potentiometric investigations on the cathodic deposition of copper in presence of iron salts. M. GELOSO and P. DESCHAMPS (Bull. Soc. chim., 1939, [v], 6, 1100-1112).-At const. temp., c.d., rate of agitation, and electrode area there is a definite concn. of Fe salt below which Cu will deposit completely. At higher [Fe] the Cu deposits and is subsequently re-dissolved. This crit. concn. of Fe is lowered by increase in temp. or in rate of agitation. Potentiometric measurements made with and without a separation of the cathodic and anodic compartments show irregularities due to cathodic formation of Fe" and anodic production of Fe", the extent of each reaction being dependent on the temp. and rate of diffusion. The potential of dissolution of Cu indicates that the cathodic re-dissolution in presence of Fe is probably due to the reaction  $Cu + 2Fe^{\cdots} = Cu^{\cdots} +$ 2Fe . J. W. S.

Electrolytic manufacture of perchloric acid from sodium chlorate.—See B., 1939, 739.

Electrodeposition of silver-lead alloys.—See B., 1939, 735.

Action of inorganic colloids on electrodeposition of nickel.—See B., 1939, 735.

Separation of isotopic molecules in a directcurrent glow discharge. W. GROTH and P. HARTECK (Naturwiss., 1939, 27, 390—391).—During the passage of a d.c. discharge pressure differences are set up between anode and cathode which result in separation of gas mixtures. The method has been used in an attempt to separate Xe isotopes, but, with the apparatus used, no separation could be detected. Some separation was, however, found with other gases which were diat. Separation to a small extent was effected with  $H_2$  and  $D_2$ . Even smaller effects would be found with other gases, as the difference between the at. wts. of the isotopes is relatively smaller, although this may be compensated for by the smaller diffusion consts. of the heavier mols.

A. J. M.

Photochemistry of heavy-metal azides. I. Structure and properties of gelatin suspensions of heavy-metal azides. S. M. MOSKOVITSCH (J. Phys. Chem. Russ., 1938, **12**, 460—467).—The shape and size of the grains of suspensions of AgN<sub>3</sub> and  $Pb(N_3)_2$  have been examined and the developability of the latent image produced by exposure to light has been demonstrated. In a first ripening of a suspension of  $Pb(N_3)_2$  the surface area of the grains increases, but in a second ripening this ceases. R. C.

Mechanism of development. I. General effect of oxidation products on the development process and the nature of the induction period. T. H. JAMES (J. Physical Chem., 1939, 43, 701-719).—A new apparatus and technique for developing in the absence of  $O_2$  are described. For all developing agents which possess a negative charge on the active ion there is an induction period which increases with the negative charge, but there is no induction period when the uncharged mol. is the active agent. Before a negative ion can produce reduction it must penetrate a potential barrier due to adsorbed halide ion. This gives rise to the induction period and implies that the chemical reaction takes place at or very near the surface of the grain. The action of a high concn. of various substances was found to be in agreement with the effect of these substances on the Z potential of the Ag halide grain. The oxidation products of org. developers increase the rate of development when the active part of the developing agent consists of bivalent ions but decreases the rate with those agents which are active as univalent ions or neutral mols. This decrease is particularly marked with members of the  $p-C_6H_4(NH_2)_2$  series but as the  $p_{\rm H}$  is increased the development rate for the compounds increases also, owing, presumably, to an increased rate of destruction of the oxidation products W. R. A. formed.

Effect of ultra-violet light on built-up multilayers. V. J. SCHAEFER (Science, 1939, 89, 465-466).—A multilayer of acid Ba stearate (I) [Ba stearate (III) + stearic acid (II)] deposited on Cr-plated steel to a thickness which shows interference colours changes in colour after a short exposure to ultraviolet light. The apparent thickness of the multilayer decreases. Similarly, a colourless film on suitable glass shows bright interference colours on irradiation. A multilayer of pure (II) undergoes a similar change in apparent thickness, but is not skeletonised like (I). Pure (III) shows a much smaller loss. By irradiating a film at 0° the photochemical effect can be separated from the subsequent evaporation of the volatile constituent. A between 2300 A. and 2700 A. are responsible for most of the photochemical decomp.

Light of shorter  $\lambda\lambda$  also decomposes layers of (I). Comparison of the rate of evaporation of the volatile products formed by irradiation with that of  $C_{10}H_{22}$ ,  $C_{14}H_{30}$ , and  $C_{16}H_{34}$  indicates that ultra-violet light splits the mols. of (II) at the CO<sub>2</sub>H group. Absorption of effective radiation by a 700-layer film of (I) reduces the effective radiation by 13%. L. S. T.

Photochemical investigations in the Schumann ultra-violet. VIII. Photochemical decomposition of ethane. K. FALTINGS (Ber., 1939, 72, [B], 1207— 1215; cf. A., 1938, I, 631).—Extinction coeffs. of  $C_2H_6$  for the Xe resonance lines  $\lambda\lambda$  1470 and 1295 A. were measured. The decomp. products are chiefly  $H_2$ ,  $C_2H_4$ , and  $C_2H_2$ , with smaller amounts of  $CH_4$ ,  $C_3H_8$ , and  $C_4H_{10}$ . At 1 atm. the quantum yields for  $H_2$ ,  $C_2H_2$ , and  $C_2H_4$  are respectively 1, 0·2, and 0·56 mol. A mixture of  $C_2H_6$  and CO containing 80% of CO gives COMe<sub>2</sub> as the main product, with a quantum yield of 0·1, and only a small amount of  $CH_2O$ . The results are best explained by regarding the primary reaction as  $C_2H_6 + h\nu = 2Me$ , after which the main products are formed as follows :  $2Me = C_2H_4 + H_2$ ;  $2Me = C_2H_2 + 2H_2$ ;  $2Me + CO = COMe_2$ . F. L. U.

Reactivity of lower hydrocarbons. VIII. Mercury-sensitised reactions of methane. deuteromethanes, and the isotopes of hydrogen (exchange reaction). IX. Mercury-sensitised reactions of methane, deuteromethanes, and the isotopes of hydrogen (condensation reaction). K. MORIKAWA (J. Soc. Chem. Ind. Japan, 1939, 42, 133-136B, 136-139B; cf. A., 1939, I, 59).-VIII. The progress of the exchange reactions  $D_2 + CH_4$ ,  $CH_4 + CD_4$ , and  $CD_4 + H_2$  was followed by measuring the absorption of sp.  $\lambda\lambda$  in the infra-red region, from which the % of C.D linkings and the proportions of the various deuteromethanes present in the mixtures were obtained. All three reactions are very similar in all respects but the first is the most rapid. The proportions of the various deuteromethanes vary with temp. The reactions proceed by chain mechanisms which also vary with temp.

IX.  $CH_4$  condenses to yield higher hydrocarbons and  $H_2$  without change of pressure under the influence of Hg resonance radiation at fairly low temp., but as the temp. rises small amounts of olefines are produced. The rate of condensation increases with rise of temp. but its extent decreases. Its rate is less in the presence of  $H_2$  or  $D_2$ , the former causing the greater depression. A possible mechanism is suggested.

T. H. G.

Kinetics of destruction of tyrosine combined in the egg-albumin molecule by ultra-violet radiant energy. F. W. BERNHART and L. E. ARNOW (J. Physical Chem., 1939, 43, 733—736).—Ovalbumin solutions of adjusted  $p_{\rm H}$  were irradiated in quartz tubes by a Hg arc and the liberated tyrosine (I) was determined. The order of the reaction is not 0, 1, or 2. By assuming that destruction of protein-combined (I) takes place as a first-order reaction and that, as a result of irradiation, other substances in ovalbumin decompose to yield, by a zero-order process, (I) or a phenol, vals. for the amount of (I) liberated have been calc. and are in good agreement with observed vals.

W. R. A.

Splitting proteins by ultra-violet light. D. C. CARPENTER (Science, 1939, 89, 251).—Monolayers of benzyl- or  $\beta$ -phenylethyl-stearylamine on N-HCl are photolysed by filtered ultra-violet light of  $\lambda$  2480 and 2537 A. The peptide chains of proteins may thus be expected to split at places where light-absorbing sidechains occur in the mol. L. S. T.

Detonation of nitrogen iodide by nuclear fission. E. FEENBERG (Physical Rev., 1939, [ii], 55, 980–981).—NI<sub>3</sub> mixed with  $U_3O_8$  and exposed to a Ra-Be neutron source for 1 min.—several hr. gave times for spontaneous detonation by a factor of ~20 > in the case of unexposed control samples. Pure NI<sub>3</sub> was unaffected by the source. Data indicate 1200 fissions per detonation or an efficiency of 0.1%. N. M. B.

Intermediate states in solid reactions : active oxides. G. HÜTTIG (J. Chim. phys., 1939, **36**, 84– 98).—A survey and discussion of recent work (cf. A., 1938, I, 578 and previous abstracts). F. L. U.

Polyborates. I. Alkali borates. A. FERRARI and A. MAGNANI. II. Tetra-alkylammonium borates. A. FERRARI and G. PARETI (Gazzetta, 1939, 69, 275–284, 284–290).—I. The prep. of a no. of polyborates of K, Rb, Cs, and  $NH_4$  is described. They can be represented by the general formula  $M_2B_{2n}O_{3n+1}, (n + 2)H_2O$ .

II. Tetraborates of NMe<sub>4</sub> and NEt<sub>4</sub> could not be prepared. The prep. of *decaborates* of NMe<sub>4</sub>, NMe<sub>3</sub>Et, NMe<sub>2</sub>Et<sub>2</sub>, NMeEt<sub>3</sub>, and NEt<sub>4</sub>, corresponding with the general formula  $[NR_4]_2B_{10}O_{16}$ , 4 or 5H<sub>2</sub>O, is described. With 5H<sub>2</sub>O this formula agrees with that mentioned above. Solubility data at 16° for some of these decarborates are given. O. J. W.

H. VON WARTENBERG (Z. Copper fluorides. anorg. Chem., 1939, 241, 381-394).-Anhyd. CuF<sub>2</sub> may be obtained by dehydration of CuF,,5HF,5H,0 at 400° in a stream of HF. It is white, transparent, mono- or tri-clinic, and melts at  $950\pm5^\circ$ , with some dissociation. It dissolves slowly in H<sub>2</sub>O, the solubility at 20° being 4.7 g. per 100 g. Its heat of formation is 129.4 kg.-cal. per g.-mol. On melting it loses F., forming red CuF, and in presence of Cu the equilibrium in the melt corresponds with 60-80% CuF. On cooling (even the most rapid chilling) the CuF breaks up into CuF2 and Cu, but in one experiment, which could not be reproduced, a transparent red solid solution of CuFin  $CuF_2$  was obtained. Even on chilling the vapour the product is CuF2 coloured red by very finely-divided Cu, but the action of HF on CuCl at approx. 650° affords on cooling a eutectic containing approx. 8% of CuF which cannot be separated from the CuCl. Even below the m.p. CuF, contains traces of CuF, and traces of  $H_2O$  in HF may be detected and removed by passage over  $CuF_2$  at 600°, for  $H_2O$  reacts irreversibly with the CuF present, forming Cu<sub>2</sub>O. F. J. G.

Dehydration of the double magnesium potassium sulphate. (MME.) N. DEMASSIEUX and B. FEDOROFF (Compt. rend., 1939, 208, 1581—1583; cf. A., 1939, I, 383).—Hydrates with  $4H_2O$  (stable at 90—120°) and  $2H_2O$  (148—155°) and the anhyd. salt (>175°) are obtained by progressive heating of  $K_2Mg(SO_4)_2, 6H_2O$ ; Debye–Scherrer diagrams are given. A tetrahydrate, which is exceptional, is also given by  $K_2Fe(SO_4)_2, 6H_2O$ . Analogous structures occur in each of the series of anhyd. K double sulphates stable at low temp. (Cu, Co, Ni, Mg) and at higher temp. (Cu, Mg). Debye–Scherrer diagrams indicate production of a monohydrate and the anhyd. salt on heating MgSO<sub>4</sub>, 7H<sub>2</sub>O and the dehydration curve shows the existence of hydrates with 6, 2.5, 2, and  $0.5H_2O$ . A. J. E. W.

Action of bromine on the anhydrous oxides of the metals in the second column of the periodic classification table. P. PIERRON (Bull. Soc. chim., 1939, [v], 6, 1054—1056).—Br<sub>2</sub> vapour is absorbed slowly by MgO and CaO with formation of MgOBr<sub>2</sub> and CaOBr<sub>2</sub>, respectively. These are fairly stable orange-coloured compounds which lose only ~10% of their Br during 3 days in a desiccator in presence of KOH. CaOBr<sub>2</sub> reddens in presence of H<sub>2</sub>O but is only slowly decomposed at 90°. When SrO is treated with Br<sub>2</sub> the SrOBr<sub>2</sub> is partly decomposed with loss of O<sub>2</sub> and formation of Sr(BrO<sub>3</sub>)<sub>2</sub> and SrBr<sub>2</sub>. BaO yields only BaBr<sub>2</sub> and Ba(BrO<sub>3</sub>)<sub>2</sub>. J. W. S.

Quantitative measurement of the natural rate of growth of calcite crystals in geodes. L. T. PATTON (Science, 1939, 89, 485).—Crystals of calcite 1:0—2:5 mm. long and 1:0 to 1:5 mm. thick have been formed in cavities of building stone in 10 years. L. S. T.

Action of bromine on alkaline-earth hydroxides in aqueous solution. P. PIERRON (Bull, Soc. chim., 1939, [v], 6, 1051—1054).—Addition of Br to saturated aq. Ba(OH)<sub>2</sub> yields only BaOBr<sub>2</sub>,H<sub>2</sub>O, which in dil. solution or on treatment with Ag<sub>2</sub>O dissociates into Ba(OBr)<sub>2</sub> and BaBr<sub>2</sub>. With the less sol. Ca(OH)<sub>2</sub> only 95% of CaOBr<sub>2</sub>,H<sub>2</sub>O is formed, whilst with Sr(OH)<sub>2</sub> only Sr(OBr)<sub>2</sub> and SrBr<sub>2</sub> are produced. J. W. S.

Action of bromine on mercuric oxide. P. PIERRON (Bull. Soc. chim., 1939, [v], 6, 1047—1051; cf. A., 1937, I, 473; 1938, I, 40).—The initial addition product HgOBr<sub>2</sub> decomposes under the action of Br, yielding Hg(OBr)<sub>2</sub> and HgBr<sub>2</sub>. As the Hg(OBr)<sub>2</sub> is formed it reacts with further Br to re-form HgOBr<sub>2</sub> and Br<sub>2</sub>O. Under conditions such that Hg(OBr)<sub>2</sub> is fairly stable (at low temp. and atm. pressure) the Br<sub>2</sub>O oxidises further Hg(OBr)<sub>2</sub> to Hg(BrO<sub>3</sub>)<sub>2</sub>, but under conditions such that the [Hg(OBr)<sub>2</sub>] is very small (in a vac. or in contact with a solution of Br in CCl<sub>4</sub>) the Br<sub>2</sub>O is decomposed with liberation of O<sub>2</sub> and the final product is only HgBr<sub>2</sub>. J. W. S.

Solubilities and separations in glasses. M. Foëx (Ann. Chim., 1939, [xi], 11, 359-452).—A review and discussion of work published by the author and others on solubilities of oxides in molten  $B_2O_3$  and  $B_2O_3$  glasses, appearance of a second phase caused by cooling or the addition of oxides, and the influence of the surrounding atm. on devitrification in SiO<sub>2</sub> glasses. F. L. U.

Aqueous corrosion of thallium. E. PLANK and A. URMÁNCZY (Z. anorg. Chem., 1939, 241, 416— 417; cf. A., 1939, I, 381).—In an atm. of  $H_2$ , and in complete absence of  $O_2$ ,  $H_2O$  or aq. TIOH has no corrosive action on Tl. F. J. G. Conditions of formation and stability of carbonyls and complex cyanides. I. B. ORMONT (J. Phys. Chem. Russ., 1938, 12, 259—270).—The author's theory of co-ordination (cf. A., 1939, I, 61) is applied to carbonyls and complex cyanides. It explains why metals (e.g., Cr) giving very stable carbonyls produce rather unstable cyanides, and metals (e.g., Co) the carbonyls of which are less stable give rise to stable cyanides. J. J. B.

Synthesis of quartz by pneumatolysis, using shattering explosives. Formation of liquid inclusions as mobile bubbles. A. MICHEL-LÉVY and J. WYART (Compt. rend., 1939, 208, 1594— 1595).—Cristobalite and spherolites of quartz have been synthesised by detonation of mixtures of hexogen with SiO<sub>2</sub> and H<sub>2</sub>O or aq. KOH, respectively, followed by heating at 550° for six days under the pressure (>3000 kg, per sq. cm.) of the detonation products. The quartz was accompanied by a vitreous residue containing liquid inclusions similar to those found in granite, and the experimental conditions are probably similar to those of the genesis of granites. (Cf. A., 1939, I, 432.) A. J. E. W.

New halides of silicon. IV. Silicon chloride of formula SiCl. R. SCHWARZ and U. GREGOR (Z. anorg. Chem., 1939, 241, 395-415; cf. A., 1938, I, 208, 410).—Besides  $(SiCl)_x$  the products of pyrolysis of Si<sub>10</sub>Cl<sub>20</sub>H<sub>2</sub> are SiCl<sub>4</sub>, Si<sub>2</sub>Cl<sub>6</sub>, Si<sub>3</sub>Cl<sub>8</sub>, Si<sub>4</sub>Cl<sub>10</sub>, SiHCl<sub>3</sub>, HCl, and  $H_2$ . (SiCl)<sub>x</sub> is a yellow amorphous solid. At 180-200° it undergoes a reversible colour-change to orange-red, and it is stable up to approx. 500°, when it breaks up into Si and saturated Si chlorides. It is stable in dry  $O_2$  at room temp., but burns at 98°, and it inflames spontaneously in  $NO_2$ , forming Si and SiO<sub>2</sub>. It is rapidly hydrolysed by  $H_2O$ , and is insol. in org. solvents or in  $SiCl_4$ . It reduces ammoniacal AgNO<sub>3</sub> to Ag, and with HNO<sub>3</sub>, after a short time or on gentle warming, it explodes. It inflames with liquid Br, but with Br vapour at 0° it reacts quietly to form a complex mixture of unsaturated Si-Cl-Br compounds and  $SiCl_4$ . The reaction with  $Cl_2$  is less violent but equally indefinite. With  $NH_3$  at 0°, ammonolysis occurs, the products being  $H_2$ ,  $NH_4Cl$ , and *compounds*  $Si_6(NH_2)_8$ and  $Si_8(NH_2)_{10}$ . At  $-25^{\circ}$  the reaction is similar but an additive compound,  $Si_8(NH_2)_{10}$ ,  $18NH_3$ , results. Controlled hydrolysis with moist  $Et_2O$  at  $-20^\circ$  affords a red compound,  $(SiOH)_x$ , and at room temp., with evolution of  $H_2$ , a yellow compound,  $Si_4(OH)_6$ . This last is also formed by the action of conc. HCl.  $(SiCl)_x$ must be regarded as a highly-polymerised and unsaturated long-chain compound, presumably with alternating double and single bonds. F. J. G.

Action of water on glass.—See B., 1939, 719.

Stability and solubility of sodium stannate. F. REIFF and S. M. TOUSSAINT (Z. anorg. Chem., 1939, 241, 372—380).—Na<sub>2</sub>Sn(OH)<sub>6</sub> always contains small amounts of NaOH which cannot be removed by washing, and it is therefore very sensitive to  $CO_2$ , but in the absence of  $CO_2$  it is quite stable either as solid or in solution at  $<50^{\circ}$ . At  $>50^{\circ}$  in solution some deposition of Sn(OH)<sub>4</sub> occurs. Its solubility in H<sub>2</sub>O and in solutions of NaOH, Na<sub>2</sub>CO<sub>3</sub>, and other Na salts has been determined at 0—120°. In H<sub>2</sub>O the solubility is >500 g. per 1. at 0°, and decreases markedly with rising temp.  $Na_2CO_3$  lowers the solubility markedly, but the shape of the curve is unchanged. Other Na salts also lower the solubility to varying extents. NaOH lowers the solubility very markedly and the shape of the curve is different, the solubility at first decreasing with rising temp., but then increasing after passing through a min. which shifts to lower temp. with increasing [NaOH]. F. J. G.

Determination of the mol. wt. of lead by the Richards-Hönigschmid method. II. Preparation of pure lead chloride. V. M. PERMJAKOV (J. Gen. Chem. Russ., 1939, 9, 381–385).—Pure PbCl<sub>2</sub> containing traces of Mg and Ca is prepared by distillation in a stream of HCl. R. T.

Existence, properties and crystal structure of  $Pb^{IV}P_2O_7$ . G. PEYRONEL (Gazzetta, 1939, 69, 254—262).—PbP<sub>2</sub>O<sub>7</sub> is obtained in good yield by the action of  $H_3PO_4$  on PbO<sub>2</sub> at 300°. It is insol. in  $H_2O$  and in acids, but may react slowly with the latter, especially if reducing agents are present; in conc. alkali solutions it is completely sol., and can be determined by addition of KI, NaOAc, and AcOH, and titration of the liberated I. PbP<sub>2</sub>O<sub>7</sub> is gradually decomposed at 400—500°, and it is isomorphous with other compounds  $M^{IV}P_2O_7$  (cf. A., 1936, 669); space-group  $T_{a}^6$ , 4 mols. in cell, a 8.01±0.01 A.,  $d_{cale}$ . 4.935. O. J. W.

Affinity. LXXXVIII. System vanadiumsulphur. W. BILTZ and A. KÖCHER (Z. anorg. Chem., 1939, 241, 324—337).—The system has been studied by means of cooling curves and X-rays, and the existence of VS and  $V_2S_3$  confirmed, but that of  $V_2S_5$  disproved. The highest sulphide is a *tetrasulphide*, VS<sub>4</sub>, which is formed as a black powder when  $V_2S_3$  is heated with S at 400°, and excess of S removed by means of CS<sub>2</sub>. It is to be identified with the mineral patronite (A., 1907, ii, 788). Its heat of formation from  $V_2S_3$  and S is 5 kg-cal. per g.-mol., and its dissociation pressure becomes 1 atm. at 460°. It dissolves completely in warm NaOH with a characteristic red colour. It is sol. in fused S, and such solutions after being heated at >400° deposit VS<sub>4</sub> on cooling, but after being heated at >500° they deposit  $V_2S_3$ . VS has the NiAs structure with a 3·34, c 5·785 A., c/a = 1.73. F. J. G.

Formation of ozone by heating persulphate solutions containing sulphuric acid in its dependence on the concentration of acid and in presence of cellulose. F. ULLRICH (J. pr. Chem., 1939, [ii], 153, 91-115).-The course of the decomp. of  $KSO_4$  in solutions with varying  $H_2SO_4$  content during boiling for 5 min. is followed by determin-ation of  $O_3$  evolved and  $KSO_4$  remaining. The possibility that  $O_3$  is due in part to the decomp. of H<sub>2</sub>SO<sub>5</sub> is strengthened by the similarity of the graphs showing the relationship between HSO<sub>5</sub> and yield of  $O_3$  on [H<sub>2</sub>SO<sub>4</sub>]. Passage of air through the boiling solutions increases appreciably the yield of O<sub>3</sub>, the rapid removal of which diminishes the tendency to secondary reduction. In presence of cellulose (filterpaper or bleached cotton tissue) there is increased formation of O<sub>3</sub>. Under identical conditions the reaction  $2\text{KSO}_4 + \text{H}_2\text{O}_2 = 2\text{KHSO}_4 + \text{O}_2$  is almost complete after boiling for 5 min.; this explains the observation that  $H_2O_2$  cannot be detected in the solutions until  $HSO_4$  has disappeared. Since also the amount of  $H_2SO_5$  in the boiled solution does not increase until  $HSO_4$  is no longer present, it appears that a similar change may occur between  $KSO_4$  and  $H_2SO_5$ . H. W.

Preparation of the dihydrate  $MoO_3, 2H_2O$ , and its cryoscopy in aqueous solution. (MILE.) M. MURGIER and Y. DOUCET (Compt. rend., 1939, 208, 1585—1586; cf. A., 1906, ii, 762; 1926, 1219).—  $MoO_3, 2H_2O$  crystallises on keeping from the solution obtained by adding cold HNO<sub>3</sub> (d 1·18) to an equal vol. of 15% aq. NH<sub>4</sub> molybdate at 70°. Addition of NH<sub>4</sub>NO<sub>3</sub> is undesirable. Vals. of the cryoscopic ratio  $\theta/m$  (m = 0.0024—0.03 g.-mol. per 1.) are identical with those for sol. molybdic acid (A., 1939, I, 262), the solutions containing H<sub>2</sub>Mo<sub>4</sub>O<sub>13</sub>. A. J. E. W.

Volatilisation of metallic compounds from solutions in perchloric or sulphuric acid. J. I. HOFFMAN and G. E. F. LUNDELL (J. Res. Nat. Bur. Stand., 1939, 22, 465—470).—Results are recorded on the extent of volatilisation of metallic compounds at  $200-220^{\circ}$  from solutions in HClO<sub>4</sub>, HClO<sub>4</sub> + H<sub>3</sub>PO<sub>4</sub>, or H<sub>2</sub>SO<sub>4</sub>, in presence of HCl or HBr. The following can be quantitatively distilled from HClO<sub>4</sub>: As, Sb, Ge, Cr, Os, Ru, Re, and Sn; and the following from H<sub>2</sub>SO<sub>4</sub>: As, Sb, Se, Ge, Re, and Sn. Partial loss of other metals, *e.g.*, Bi, Au, Mo, Te, Tl, may occur.

F. J. G. Affinity. LXXXIX. Cobalt phosphides. W. BILTZ and M. HEIMBRECHT (Z. anorg. Chem., 1939, 241, 249—360).—The system Co-P has been studied by means of cooling curves, tensimeter curves, and X-rays. Of the various phosphides recorded in the lit. only Co<sub>2</sub>P and CoP exist, but there is also a triphosphide, CoP<sub>3</sub>. From the dissociation pressures, the heat of formation of CoP<sub>3</sub> from CoP is 30 kg.-cal. per g.-mol., and that of CoP from Co<sub>2</sub>P is 9 kg.-cal. per g.-mol. CoP<sub>3</sub> is isomorphous with NiP<sub>3</sub> (A., 1938, I, 313), but Co<sub>2</sub>P is not isomorphous with NiP<sub>2</sub>. Data on  $\rho$  for Co-P preps. are recorded. The mol. vols. of Co<sub>2</sub>P, CoP, and CoP<sub>3</sub> are 10·3, 14·2, and 35·7, respectively. F. J. G.

Preparation and properties of the hexagonal form of nickel. G. LE CLERC and A. MICHEL (Compt. rend., 1939, 208, 1583—1585; cf. A., 1931, 1217).— A form of Ni having a compact hexagonal structure  $(a \ 2.65, c \ 4.32 \ A., c/a \ 1.63)$  is obtained on heating the cubic form in CO at 170° for several days. This form is non-ferromagnetic; on heating at >250° the cubic form, with normal magnetic properties, is produced. Transformation into the cubic form is accompanied by absorption of heat and a vol. contraction of  $5.4°_{0.4}$ , in agreement with the at. vols. (13.1 and 11 cu. A.). Cubic Ni is metastable at room temp. A. J. E. W.

Palladium carbide. N. G. SCHMAHL (Congr. int. Quim. pura apl., 1934, 9, III, 468—473; Chem. Zentr., 1936, ii, 4200—4201).—The action of  $CH_4$ or  $CH_4$ -H<sub>2</sub> mixtures (at 750°) on Pd, prepared by reduction of PdO with H<sub>2</sub>, ceases as soon as the solid contains 4.4% of C, corresponding with the compound  $Pd_5C_2$ . The product has the same capacity for H adsorption as Pd; its X-ray diagram permits a tetragonal structure, which is probably of the double interstitial type. A. J. E. W.

Spectrographic analysis.—See B., 1939, 733.

Hydrogen-ion activity and buffer capacity of natural and treated waters. A. P. BLACK and E. BARTOW (Ind. Eng. Chem. [Anal.], 1939, 11, 261— 264).—The effect of the method of prep. of quinhydrone (I), the use of (I) reference electrodes, and the effect of buffer capacity of waters on determination of  $p_{\rm H}$  vals. have been investigated. Purity of (I) is essential, especially when working with weakly buffered solutions. (I) of satisfactory quality can be prepared using Fe<sup>III</sup> alum (cf. A., 1927, 221, 533), and by Valeur's method (A., 1901, i, 154). Vals. for  $p_{\rm H}$  of different waters obtained with the (I) electrode are consistently lower than corr. colorimetric vals. For an accuracy of 0·1  $p_{\rm H}$  unit, the (I) electrode can be used with waters of fairly high alkalinity (~300 p.p.m.) up to  $p_{\rm H}$  7·5, but is not suitable for waters of low alkalinity (<100 p.p.m.) above  $p_{\rm H}$  7·0.

L. S. T. Fluorescent indicators. II. K. A. JENSEN (Z. anal. Chem., 1939, 117, 50-51; cf. A., 1933, 1132).-The  $p_{\rm H}$  ranges over which changes in the intensity of fluorescence of  $\beta$ -methylumbelliferone derivatives are observed are as follows: 8-chloro- 5-7, 8bromo- 5-7, 6:8-dichloro- 4-6, and 3:6:8trichloro-7-hydroxy-4-methylcoumarin 3-5. 3:5:8-Trichloro-6:7-dihydroxy-4-methylcoumarin shows scarcely any fluorescence but undergoes a colour change from colourless to yellow at  $p_{\rm H}$  3-5, corresponding with the change from a deep blue to a light green fluorescence observed with 6:7-dihydroxy-4-methylcoumarin at  $p_{\rm H}$  9-10. Coumarin derivatives act as indicators only when there is a free OH present. J. W. S.

Screened methyl-orange. R. F. INNES (Analyst, 1939, 64, 419—420).—A sample of xylene-cyanol FF failed to act satisfactorily at the specified concn., but acted at double this concn. E. C. S.

Determination of water in silicates. C. O. HARVEY (Bull. Geol. Survey, Gt. Britain, 1939, No. 1, 8—12).—The sample ( $\sim 2$  g.) in a Pt boat is placed in a SiO<sub>2</sub> test tube and heated over a Meker burner. A weighing bottle containing 4—5 g. of carbonated CaCl<sub>2</sub> fits over the open end of this tube and absorbs the H<sub>2</sub>O evolved. Details of procedure, test data, and comparative results obtained by the SiO<sub>2</sub> combustion tube method are recorded.

L. S. T.

Possibility of supercooling heavy water and its mixtures with ordinary water. L. STARONKA (Rocz. Chem., 1939, 19, 317–322).—The stability of supercooled liquid H<sub>2</sub>O at  $-20^{\circ}$  is > of 99.9% D<sub>2</sub>O. That of 45% D<sub>2</sub>O = that of H<sub>2</sub>O, and of 10% D<sub>2</sub>O is > of H<sub>2</sub>O. 0.01% of D<sub>2</sub>O can be detected in H<sub>2</sub>O by measurement of the time during which H<sub>2</sub>O remains liquid at  $-20^{\circ}$ . R. T.

Determination of moisture in brown coals.— See B., 1939, 682.

Determination of iodine in "airol."—See B., 1939, 775.

Determination of hydrofluoric acid and of "uncombined" acid in alkali and ammonium fluorides. J. H. VAN DER MEULEN (Chem. Weekblad, 1939, 36, 476).—Free HF in "neutral" alkali metal or  $NH_4$  salts is determined by boiling with neutral CaCl<sub>2</sub> solution and determining the liberated HCl titrimetrically with 0.2N-NaOH (Me-orange or Me-red) or iodometrically after adding KI and KIO<sub>3</sub> solutions. In the latter case the pptd. CaF<sub>2</sub> tends to adsorb I and starch. S. C.

Determination of oxygen in air. O. ISHIZAKA (J. Pharm. Soc. Japan, 1938, 58, 60—61).—Using the apparatus designed for determining  $CO_2$  with alkaline pyrogallol, the  $O_2$  content is found to be  $22\cdot6-23$  vols.-%. H. B.

Gravimetric determination of sulphur in cast iron and steel.—See B., 1939, 726.

Pregl sulphur combustion of metallic compounds.—See A., 1939, II, 397.

Determination of hydrogen sulphide in commercial gases.—See B., 1939, 716.

Detection of toxic gases and vapours in industry.—See B., 1939, 782.

Ferrous dimethylglyoxime oxidation-reduction indicator in the titration of hyposulphites with ferricyanide. G. CHARLOT (Bull. Soc. chim., 1939, [v], 6, 977-979).-A drop of 0.02N-FeCl<sub>3</sub> and 4-5 drops of dimethylglyoxime solution (saturated in EtOH) are diluted to 100 c.c. and buffered to  $p_{\rm ff} \sim 9.4$  by addition of conc. aq. NH<sub>3</sub> (7 c.c.) and  $\dot{NH}_4Cl$  (5 g.). The solution to be titrated is added and the  $K_3Fe(CN)_6$  is run in until the colour changes from red to pale yellow. The colour change is reversible, being sharp for 0.1N. solutions, whilst 0.02N. solutions can be used. There is no correction for oxidation of the indicator, but as the change point of the indicator is at 0.25 v. and that of the oxidation reaction is at 0.09 v., there is a tendency to add a drop too much  $K_3Fe(CN)_6$ . The titration is best conducted in an atm. of N2 to avoid oxidation. J. W. S.

Conductometric determination of selenious acid with silver ion. R. RIPAN-TILICI (Z. anal. Chem., 1939, 117, 47–49).—The solution is neutralised to  $p_{\rm H}$  9 with 0.5M-aq. NaHCO<sub>3</sub> before titrating conductometrically with 0.5M-AgNO<sub>3</sub>. Data are recorded for the titration of 0.01–0.0025M-Na<sub>2</sub>SeO<sub>3</sub>.

J. W. S.

Qualitative separations on a micro-scale. Analysis of the tellurium and copper groups of A. A. Noyes and W. C. Bray. B. S. ALSTODT and A. A. BENEDETTI-PICHLER (Ind. Eng. Chem. [Anal.], 1939, 11, 294—298; cf. A., 1939, I, 217).—The mg. procedure detailed for these groups retains the essential features of the Noyes-Bray scheme, and provides for the isolation, confirmation, and estimation of 10  $\mu$ g. of any member of the groups in presence of 500  $\mu$ g. of any other member. Te is confirmed as lemon-yellow hexagons and triangles of Cs<sub>2</sub>TeCl<sub>6</sub>, Mo by the blue colour of the residue from the Et<sub>2</sub>O extract, the red coloration with CNS' and Zn, and the black ppt. of MoS<sub>3</sub>, Ir as reddishbrown crosses and octahedra with (CH<sub>2</sub>)<sub>6</sub>N<sub>4</sub>, Rh as the red coloration obtained with  $SnCl_2$ , Pb as  $K_2PbCu(NO_2)_6$  or  $PbCrO_4$ , Bi as  $Cs_3Bi_2I_9$ , and Cu as Cu Hg thiocyanate. L. S. T.

Thermal conductivities of some binary gas mixtures. F. ISHIKAWA and K. HIJIKATA (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 401— 415).—An investigation of the applicability of a heat conductivity method of gas analysis to chemical problems. The variation of conductivity with pressure up to 1 atm. has been measured for N<sub>2</sub>, H<sub>2</sub>, and CO, and for the binary mixtures N<sub>2</sub>-H<sub>2</sub> and CO-H<sub>2</sub>. The compositions of mixtures can be determined with an error of <0.1%. The experimental technique consists in using a conductivity wire as one arm of a Wheatstone bridge and measuring the voltage (which is  $\propto$  current) necessary to keep the temp. of the wire const. T. H. G.

Volumetric determination of phosphoric acid on the basis of the method of N. von Lorenz with the use of reversed filtration. Working up the molybdenum residues. L. GISIGER (Z. anal. Chem., 1939, 117, 17–24; cf. A., 1939, I, 97).—To recover the Mo from the filtrates obtained after pptn. of  $PO_4^{\prime\prime\prime}$  the solution (80 l.) is treated with conc. aq.  $NH_3$  (23–25 l.) during 4.5–6 hr. with continuous stirring, after which the mixture is kept for 24 hr. The clear solution is decanted off and the ppt. freed from mother-liquor by suction and finally by washing with H<sub>2</sub>O. After determination of the  $NH_4$  and Mo contents, the residue is used for prep. of fresh reagent solution. Titration residues can be dissolved in aq.  $NH_3$  and the  $PO_4^{\prime\prime\prime}$  pptd. with the theoretical amount of  $Mg(NO_3)_2$ . The solution is then worked up with the filtrates from the pptn. process. J. W. S.

Micro-determination of carbon in steel.—See B., 1939, 729.

Analysis of minerals from Canali Serci. N. COLLARI (Period. Min., 1936, 7, 179–185; Chem. Zentr., 1936, ii, 1510).—Analytical processes are described. A. J. E. W.

Determination of potassium and the potassium content of normal voluntary muscle.—See A., 1939, III, 735.

Semi-direct determination of potassium oxide in felspars.—See B., 1939, 720.

Systematic synthesis of atomic groups in analytical chemistry. VII. Reactions and formation of salts of 1-phenyl-3-methyl-5-pyrazolone and of oximino- $\psi$ -thiohydantoin. J. V. DUBSKÝ (Pub. Fac. Sci. Univ. Masaryk, 1939, No. 271, 15 pp.).—The greyish-white Ag salt, the pale reddishbrown Ag<sup>II</sup> salt, the inner complex Cu salt, the Fe<sup>"</sup>, Co<sup>"</sup>, and the corresponding diol-cobalti-salts of 1phenyl-3-methyl-5-pyrazolone, and the inner complex Ag, Cd, Co, Pb, Cu, and Ni salts of oximino- $\psi$ -thiohydantoin of the general formula (C<sub>3</sub>HN<sub>3</sub>SO<sub>2</sub>)M<sup>II</sup>,(OH<sub>2</sub>)<sub>x</sub> are described. With Ba<sup>"</sup> and Ca<sup>"</sup>, only the complex diol-salts of the type [(C<sub>3</sub>H<sub>2</sub>N<sub>3</sub>SO<sub>2</sub>)Ba(OH)]<sub>2</sub>(H<sub>2</sub>O)<sub>x</sub> could be prepared. L. S. T. Systematic synthesis of atomic groups in analytical chemistry. V. Reactions of the group S: $\dot{C}$ ·NH· $\dot{C}$ : with specific affinity for silver. J. V. DUBSKÝ and V.  $\check{C}$ ERNÁK (Pub. Fac. Sci. Univ. Masaryk, 1939, No. 269, 20 pp.; cf. A., 1939, I, 217).—Investigation of the reactions of 2-thiohydantoin and its condensation products with numerous aldehydes etc. with salts shows a selective reaction not only with Ag and Hg salts but also with those of Pb and Cu. This is attributed to the presence of the second NH. Noteworthy reactions are: 2-thiohydantoin–NO·C<sub>6</sub>H<sub>4</sub>·NHPh, Ag<sup>•</sup> violet-red ppt. (0·2  $\mu$ g.), Hg<sup>•</sup> red ppt. (0·4  $\mu$ g.), Cu<sup>•</sup> dark-blue ppt. (0·6  $\mu$ g.); 2-thiohydantoin–p-NMe<sub>2</sub>·C<sub>6</sub>H<sub>4</sub>·CHO, Ag<sup>•</sup> red-orange ppt. (0·9  $\mu$ g.), Hg<sup>•</sup> vermilion-red ppt. (0·5  $\mu$ g.), Hg<sup>•</sup> carmine-red ppt. (0·2  $\mu$ g.); 2-thiohydantoin–NO·C<sub>6</sub>H<sub>4</sub>·NMe<sub>2</sub>, Ag<sup>•</sup> violet ppt. (1·2  $\mu$ g.), Hg<sup>•</sup>, blue ppt. (0·2  $\mu$ g.), Hg<sup>•</sup> blue ppt. (0·5  $\mu$ g.), and Cu<sup>•</sup> black-violet ppt. (0·158  $\mu$ g.). Limiting sensitivities are given in parentheses. L. S. T.

Qualitative analysis without hydrogen sulphide. C. J. BROCKMAN (J. Chem. Educ., 1939, 16, 133–138).—Ag, Pb, and Hg<sup>I</sup> are pptd. as usual, and Ba, Sr, Ca, and Pb as sulphates with dil. H<sub>2</sub>SO<sub>4</sub> and EtOH. Sn, Al, Sb, Zn, Cr, and As are extracted from the filtrate by treatment with KOH and Na<sub>2</sub>O<sub>2</sub>, and the insol. hydroxides dissolved in acid. Mn, Fe, Bi, and Mg are pptd. as phosphates by neutralising this solution with  $(NH_4)_2CO_3$  and adding aq. NH<sub>3</sub> and  $(NH_4)_2HPO_4$ . The filtrate contains complex NH<sub>4</sub> salts of Cu, Hg, Co, Ni, and Cd. Details of these separations and of those in the groups are given. L. S. T.

## Analysis of glass.—See B., 1939, 719.

Potentiometric determination of zinc. D. G. STURGES (Ind. Eng. Chem. [Anal.], 1939, **11**, 267– 268).—Zn can be determined with a precision equal to that obtained with indicators by adding an excess of aq.  $K_4$ Fe(CN)<sub>6</sub>, and back-titrating the excess potentiometrically with aq. Ce(SO<sub>4</sub>)<sub>2</sub>, using a Pt-W electrode pair. The titration should be carried out at room temp., and the mixed solutions kept for 15 min. before titrating. Addition of  $K_4$ Fe(CN)<sub>6</sub> to a hot solution containing Zn<sup>\*\*</sup> should be avoided owing to decomp. HCl decreases the inflexion potential sufficiently to make an end-point difficult to obtain. NH<sub>4</sub>Cl has no effect; free HCl should be neutralised with aq. NH<sub>3</sub>, and the solution acidified up to >2N. with H<sub>2</sub>SO<sub>4</sub>. KMnO<sub>4</sub> can be substituted for Ce(SO<sub>4</sub>)<sub>2</sub> when the [Zn] is >30 mg. per 100 ml. L. S. T.

Determination of traces of zinc in biological material and natural waters. N. L. ALLPORT and C. D. B. Moon (Analyst, 1939, 64, 395-402).— Traces of Zn are extracted from aq. liquids with dithizone in CHCl<sub>3</sub> in presence of  $m \cdot C_6H_4(OH)_2$ . A method for separating large quantities of heavy metals as sulphides without adsorption of Zn is described. The procedure for determining Zn colorimetrically is detailed, the test being of sufficient sensitivity that small samples of biological material are required and the preliminary evaporation of large vol. of  $H_2O$  is obviated. Of the commonly occurring metals only Ni and Co interfere. E. C. S.

Analytical applications of dimine (cyclohexylethylamine dithiocarbamate). (MME.) M. HERR-MANN-GURFINKEL (Bull. Soc. chim. Belg., 1939, 48, 94-103).-0.5% aq. dimine

MANA-GORFINKEL (Bull. 30c. chill. Beg., 1939, 43, 94—103).—0.5% aq. dimine  $(C_6H_{11} \cdot NEt \cdot CS \cdot S \cdot NH_2 Et \cdot C_6H_{11})$  (I) yields white ppts. with Pb, Hg<sup>II</sup>, As<sup>III</sup>, As<sup>V</sup>, Sb<sup>III</sup>, and Zn; yellowishwhite with Cd and Sb<sup>V</sup>; yellow with Ag, Bi, and Sn<sup>IV</sup>; brown with Cu, Fe<sup>II</sup>, Fe<sup>III</sup>, and Mn<sup>II</sup>; green with Ni and Co; grey-black with Hg<sup>I</sup>, and brick-red with UO<sub>2</sub><sup>...</sup>. With Sn<sup>II</sup> the ppt. is white in neutral solution and yellow in acid solution. With MoO<sub>4</sub><sup>...</sup> in neutral solution the reagent gives a yellow ppt., but this turns red in acid solution or on addition of Al<sup>...</sup>, and becomes brownish-rose in presence of Zn<sup>...</sup> or Bi<sup>...</sup>. The limits of sensitivity of the method for detection of these metals are recorded. In absence of other metals pptd. by (I), Cu and Fe can be determined by pptn. with a 10—50% excess of aq. (I), the ppt. being separated, washed with dil. aq. (I); ignited, and weighed as CuO or Fe<sub>2</sub>O<sub>3</sub>. Fe<sup>III</sup> can be separated from Cr by pptn. with aq. (I) from a solution 0.05N. in HCl. J. W. S.

Determination of lead in steel.—See B., 1939, 729.

Iodometric determination of copper in nitric acid solution. S. K. HAGEN (Z. anal. Chem., 1939, 117, 26—30).—The sample containing  $\sim 0.2$  g. of Cu is dissolved in 10 c.c. of dil. HNO<sub>3</sub> and the solution is boiled until no further brown fumes are evolved. 10 c.c. of diluent solution {Pb(NO<sub>3</sub>)<sub>2</sub> 1.5 g., CO(NH<sub>2</sub>)<sub>2</sub> 100 g., and a little HNO<sub>3</sub> per 1.} are added and the solution is shaken vigorously and cooled to room temp. It is then treated with 10 c.c. of aq. KCNS (10%) and 10 c.c. of aq. KI (1%) and titrated immediately with 0.1N-Na<sub>3</sub>S<sub>2</sub>O<sub>3</sub>. J. W. S.

Separation and determination of copper and nickel by salicylaldoxime. Effect of hydrogenion concentration. L. P. BIELFELD and D. E. HowE (Ind. Eng. Chem. [Anal.], 1939, 11, 251-253).—The effect of  $p_{\rm H}$  on the pptn. of Cu" and Ni" by salicylaldoxime (I) has been investigated for pure solutions and for mixtures containing Cu + Ni, and Cu + Fe. The Cu-(I) complex starts to ppt. quantitatively from pure solutions at  $p_{\rm H}$  2.6, and the Ni complex at 7.0. The Ni complex starts to ppt. at  $p_{\rm H}$  3.3. The  $p_{\rm H}$  range of separation of Cu from Ni is 2.6—3.1. Entrainment of the Ni complex by Cu is very small at  $p_{\rm H}$  3.1, even with a ratio of Ni : Cu = 20:1. Entrainment of the Fe-(I) complex occurs over a wide range of  $p_{\rm H}$ , and is probably not due solely to adsorption. The amount decreases with a rise in  $p_{\rm H}$ . (I) is a suitable reagent for the determination of Cu in certain alloys. Determinations of Ni by means of (I) or dimethylglyoxime have the same precision, but the former reagent affords a more rapid method and gives a ppt. that is easier to handle. L. S. T.

Reactions of aminophenols with copper and iron.—See A., 1939, II, 314.

Colorimetric determination of small quantities of copper in medicinal preparations.—See B., 1939, 775. Ceriometric determination of copper in Parisgreen and ores.—See B., 1939, 761.

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#### [Determination of] traces of copper in gasoline. —See B., 1939, 688.

Tetraphenylarsonium chloride as an analytical reagent. Determination of mercury, tin, cadmium, and zinc. H. H. WILLARD and G. M. SMITH (Ind. Eng. Chem. [Anal.], 1939, 11, 269-274; cf. A., 1939, I, 336).-The determination of Hg depends on the reaction  $2AsPh_4 + HgCl_4'' \rightarrow$ [AsPh<sub>4</sub>]<sub>2</sub>HgCl<sub>4</sub>, which is white, cryst., sol. in H<sub>2</sub>O, but insol. in aq. NaCl. Hg<sup>\*\*</sup> (0.5—100 mg.) is pptd. by AsPh<sub>4</sub>Cl (I) in 30—120 ml. of 1—2.5M-NaCl, and the excess of (I) titrated potentiometrically with I. In pure solutions, the error is  $\sim \pm 0.06$  mg. of Hg. A gravimetric determination is not possible as no suitable wash-liquid has been found. Free acid (0.2-1.0M.), except HNO<sub>3</sub>, does not interfere, but MnO<sub>4</sub>', ReO<sub>4</sub>', ClO<sub>4</sub>', IO<sub>4</sub>', I', Br', F', WO<sub>4</sub>'', MoO<sub>4</sub>'', CrO<sub>4</sub>'', CNS', Bi.'', Pt''', Sn'', Zn'', Cd'', TI", Au", and ions which react with I' or I must be absent. Interference by Cu", Sn"", Mn", Fe" and Ti can be overcome by the formation of suitable complexes. Sn<sup> $\cdots$ </sup> (0.80–84.0 mg.) in a vol. of 30–120 ml. can be determined by pptn. as [AsPh<sub>4</sub>]<sub>2</sub>SnCl<sub>6</sub> and potentiometric titration of the excess of reagent with I, or titration of the dissolved ppt. The ppt. should be formed in 0.4-2.0M-HCl and 1.5—3.0M-NaCl. Fe<sup>••</sup>, >25 mg. of Fe<sup>••</sup>, Pt<sup>•••</sup>, Au<sup>••</sup>, Bi<sup>••</sup>, Hg<sup>••</sup>, Cd<sup>••</sup>, Zn<sup>••</sup>, Sb<sup>•••</sup>, Tl<sup>•••</sup>, As<sup>••</sup>, UO<sub>2</sub><sup>••</sup>, F<sup>•</sup>, C<sub>2</sub>O<sub>4</sub><sup>''</sup>, PO<sub>4</sub><sup>'''</sup>, OAc<sup>'</sup>, and anions pptd. by (I) must be absent. The error is  $\geq \pm 0.06$  mg. of Sn. Cd and Zn can be determined by procedures similar to the above. The ppts. of  $[AsPh_4]_2CdCl_4$  and  $[AsPh_4]_2ZnCl_4$  are more sol. than the compounds formed with Hg" and Sn"". Pptn. should be effected in 3.0-3.5M-NaCl and >0.4M-HCl. The same interferences occur as with Hg and Sn, and Cu", Co", Mn", and Fe" interfere more seriously. Interference by small [Sn ""] can be avoided by the addition of tartrate. Data showing the effects of different ions on these determinations are recorded. The effects of variation in the conditions of pptn. are also detailed. Linom 8 to mL. S. T.

New organic qualitative reagents. J. W. SMITH and H. E. ROGERS (J. Chem. Educ., 1939, 16, 143—144).—The colours obtained by pptg. Hg<sup>I</sup>, Ag, Pb, Sb<sup>III</sup>, Sn<sup>II</sup>, Ca, Ba, and Sr as carbonate, sulphate, or hydroxide in presence of Bordeaux-red (I), brilliantviolet, brilliant-yellow (II), brilliant-green, phloxine, pyronin, phenosafranine, fluorescein, alizarin-red S, naphthol-yellow, erythrosin, ponceau 2R, Bismarckbrown B, and Hoffmann-violet 3R are recorded. With (II) Ag' pptd. as Ag<sub>2</sub>SO<sub>4</sub> gives a characteristic, orangecoloured ppt. With (I), Sb<sup>III</sup>, pptd. by aq. NH<sub>3</sub>, gives a characteristic pink ppt., and a pink solution with 0.001 g. of Sb per ml.; Sn<sup>III</sup> gives a white ppt. HCl solutions of Sb<sup>III</sup> and Sn<sup>IIII</sup> have no effect on the colour of the dye, but those of Sn<sup>III</sup> discharge it immediately. Ca<sup>III</sup>, pptd. as Ca(OH)<sub>2</sub> in presence of (II), gives a pink ppt., whilst Ba<sup>III</sup> and Sr<sup>III</sup> give orange-coloured ppts. and solutions. L. S. T.

Detection and determination of small amounts of cerium with ferrous o-phenanthroline. G. CHARLOT (Bull. Soc. chim., 1939, [v], 6, 1126-1127).—The oxidation-reduction indicator solution is prepared by dissolving o-phenanthroline (3 mols.) and FeSO<sub>4</sub> (1 mol.) in H<sub>2</sub>O to yield a solution 0.025 M. in (C<sub>12</sub>H<sub>8</sub>N<sub>2</sub>)<sub>3</sub>Fe<sup>\*\*</sup>. The solid under test, or its solu-tion in H<sub>2</sub>SO<sub>4</sub> and Na bismuthate (I) until gas is evolved freely. After filtering a drop of the indicator is added. In absence of Ce the solution is coloured red, but in its presence it turns pale blue.  $MnO_4'$ ,  $Cr_2O_7''$ , and  $VO_3'$  also oxidise the indicator and interfere with the test. Cl', if present, must be removed by boiling with an excess of (I). The test permits the detection of 0.2— 0.3 mg. of Ce in 100 c.c. of solution. Small amounts of Ce can be determined by oxidation to  $Ce^{IV}$  with (I) and titration with 0.005M-indicator solutions until a rose colour develops. A blank test should be made with (I) alone to confirm its purity. J. W. S.

Separation and determination of aluminium and beryllium using tannin. M. L. NICHOLS and J. M. SCHEMPF (Ind. Eng. Chem. [Anal.], 1939, 11, 278-280).-Investigation of the effect of [NH<sub>4</sub>OAc] on the pptn. of Al and Be hydroxides shows that the addition of  $NH_4OAc$  raises the pptn.  $p_{\rm H}$  of the solution above that at which the hydroxides normally start to ppt. in the cold, and that Be probably forms a more stable complex with acetate than does Al, and is not so readily or completely hydrolysed. The addition of tannin (I) to these solutions followed by boiling gives heavy ppts. with Al when the  $p_{\rm H}$  is >3.39, and a slight opalescence with Be at  $p_{\rm H} 4.66$ , which increases as the  $p_{\rm H}$  is raised. With Be, the formation of the (I) complex is not compatible with the view (A., 1927, 846) that Be(OH)<sub>2</sub> forms a sol. complex with NH<sub>4</sub>OAc and (I); further, freshly-pptd. Be(OH), is not dissolved (loc. cit.) to form a clear solution when treated with a 3% solution of (I) in saturated aq. NH<sub>4</sub>OAc. Data given for the effect of  $p_{\rm H}$ , (I) concn., and digestion time show that recovery of Al is complete at  $p_{\pi} 4.6 \pm 0.1$ , with a (hot) digestion time of < 1 hr. after addition of (I), that the amount of (I) should be < 12-15 times the wt. of Al<sub>2</sub>O<sub>3</sub>, and that the ppts. dried at 110° do not suffer a const. percentage loss on ignition at 1200-1300°. The Be ppt. does not require digestion. Details for the separation and determination of Al and Be based on the above findings are given, and test data recorded. Contrary to the statement of Moser et al. (loc. cit.), the presence of Cl' does not prevent the separation of Al from Be L. S. T. by this method.

Colorimetric determination of manganese with periodate. J. P. MEHLIG (Ind. Eng. Chem. [Anal.], 1939, 11, 274–277).—Spectrophotometric investigation shows that this method (A., 1918, ii, 84) is satisfactory with few limitations.  $H_2SO_4$ ,  $HNO_3$ , or  $H_3PO_4$  may be present in widely varying concns., and a large excess of periodate may be used. Beer's law is obeyed, and the colour is stable in diffused light for  $\leq 2$  months. Of the 56 ions the effect of which has been studied, only a few which are coloured interfere seriously with the determination. When Ba", Pb", Ca", or Sr" is present,  $H_3PO_4$  should replace  $H_2SO_4$ . The colour due to Fe<sup>•••</sup> is satisfactorily removed by  $H_3PO_4$ . Bi and  $Sn^{II}$  should be removed owing to the insolubility of their periodates in solutions of high acid conen. L. S. T.

Oxidation-reduction indicators. G. CHARLOT (Bull. Soc. chim., 1939, [v], 6, 970-977).-Fe" dimethylglyoxime is a reversible and very sensitive oxidation-reduction indicator, which can be used with advantage in ammoniacal solution. At  $p_{\rm H}$  9.4 the change occurs at +0.025v, this val. being influenced to only a negligible extent by the concn. of reactants. The colour change depends on the fact that the Fe<sup>II</sup> complex is so unstable that it is oxidised at the same potential as Fe" ions; no oxidation of the dimethylglyoxime itself occurs. Sulphosalicylic acid, pyrocatechol, 8-hydroxyquinoline, and pyramidone all give coloured products with Fe", which can act as oxidation-reduction indicators in acid solution owing to reduction of Fe<sup>III</sup> to Fe<sup>II</sup>, but the colours produced by interaction of Fe<sup>III</sup> with thioglycollic acid and CH,:N.OH in alkaline solution are discharged irreversibly on reduction, owing to decomp. of the org. compounds. J. W. S.

Titrations with a tellurium electrode. S. DE BROUWER (Bull. Soc. chim. Belg., 1939, 48, 158— 163).—A Te electrode the surface of which has been freed from grease and lightly rubbed with emery gives good results in the titration of mild oxidising agents such as  $CrO_4''$  and OCI' provided adequate time is allowed for the attainment of equilibrium. Addition of  $TeO_2$  and a stream of  $CO_2$ -free air during the titration are unnecessary. F. H.

Control of the cyanogen bands of the graphite arc, when determining chromium spectrographically in plant material.—See A., 1939, III, 804.

Gravimetric determination of molybdenum as molybdenum trioxide. M. STRAUMANIS and B. OGRINS (Z. anal. Chem., 1939, 117, 30-47).-Incomplete pptn. of H<sub>2</sub>O-sol. molybdates by H<sub>2</sub>S is due to formation of Mo-blue and of sulphomolybdates and to the solubility of MoS<sub>3</sub> in acids. Pptn. is most complete when the molybdate concn. is >30 mg. per 100 c.c. and the acid concn. 0.02-0.1N. AsO<sub>4</sub>", PO<sub>4</sub>", and strong oxidising agents must be absent. H<sub>2</sub>S is passed briskly through the cold solution for 5-10 min., after which the solution is boiled for 10 min. with the H<sub>2</sub>S still passing, cooled, and filtered. The ppt. is heated gently at first and finally ignited at 500° for 15 min. and weighed as MoO<sub>3</sub>. Under at 500° for 15 min. and weight are only  $\sim 0.5\%$  too lot J. W. S. too low.

Potentiometric determination of molybdenum in ferromolybdenum.—See B., 1939, 729.

Rapid quantitative spectrum analysis of ores, particularly for determination of tin.—See B., 1939, 731.

Photometric determination of vanadium in steel.—See B., 1939, 729.

Determination of antimony in ores and concentration products.—See B., 1939, 731.

Volumetric semi-micro-determination of antimony in white metals.—See B., 1939, 731.

H. Separation of tantalum and niobium. WIRTZ (Z. anal. Chem., 1939, 117, 6-9).-The mixture of  $Ta_2O_5$  and  $Nb_2O_5$  (~0.8 g.) is weighed into a porcelain crucible and fused with  $\text{KHSO}_4$  (~10 g.). The product is dissolved in warm 5% ( $\text{NH}_4$ )<sub>2</sub>C<sub>2</sub>O<sub>4</sub> (~100 c.c.) and the solution is diluted to 400 c.c. A few drops of bromophenol-blue solution and 1-2c.c. of conc.  $H_2SO_4$  are added, and after boiling dil. aq. NH<sub>3</sub> is added slowly until the colour becomes distinctly purple. The Ta and Ti, together with a small amount of Nb, are then pptd. by addition of 2% aq. tannin, to which 10 g. of  $NH_4Cl$  has been added. The mixture is boiled for 20-30 min., the vol. being maintained at 400 c.c., after which the ppt. is collected, washed with hot 2% NH4Cl, and ignited. The Nb pptd. with the Ta is determined by reduction with amalgamated Zn, followed by titration with  $KMnO_4$ , either after addition of  $Fe_2(SO_4)_3$  or in an atm. of CO<sub>2</sub>, and is deducted from the total wt. of residue. The removal of most of the Nb by the tannin separation minimises error owing to inaccuracies in the titration of this element. Provided that the  $p_{\rm H}$  is correctly adjusted before pptn. only 0.01 g. of Nb<sub>2</sub>O<sub>5</sub> is pptd. If Ti is present or is added to facilitate the titration its oxidation from Ti<sup>III</sup> J. W. S. to Ti<sup>IV</sup> must be allowed for.

Determination of gold in cyanide plating solutions.—See B., 1939, 736.

Development and problems in liquid thermometry. W. GRUNDMANN (Glas u. Appar., 1936, 17, 137—139, 147—148, 159—160, 169—171, 179— 180; Chem. Zentr., 1936, ii, 4239; cf. A., 1938, I, 476).—The choice of a dye for colourless liquids, and difficulties due to changes in the glass, are reviewed. The Six thermometer and the properties of the creosote oil used in its construction are studied in detail. Pure Hg can be supercooled 2.5—3° or more in a Six thermometer. A. J. E. W.

Thermo-regulator and relay assembly. D. GREIFF (Science, 1939, 89, 468).—An arrangement giving a temp. control varying  $< \pm 0.05^{\circ}$  over a continuous run of 3 months is described. L. S. T.

Comparative investigation of the usual and the adiabatic methods of determining the heat capacity of solids at low temperatures. N. FEODOSIEV (J. Phys. Chem. Russ., 1938, 12, 291— 307).—Adiabatic and non-adiabatic measurements of the  $c_p$  of an empty calorimeter agree, but  $c_p$  of KCl appears smaller in the adiabatic method. This is presumably due to the slow reaching of the temp. equilibrium in the badly conducting KCl, which impairs the non-adiabatic method. Vals. are recorded for  $c_p$  of KCl between — 190° and 25°. J. J. B.

High-temperature vacuum calorimeter of the copper block type. L. G. CARPENTER and A. R. BRYANT (J. Sci. Instr., 1939, 16, 183—192).—A precision calorimeter in which the Cu block may be at any temp.  $>500^{\circ}$  and the specimen at any temp.  $>1000^{\circ}$  is described. The whole apparatus is

enclosed in an evacuated vessel. Random errors in the determination of the sp. heat are >0.3%. D. F. R.

Micro-apparatus for temperature-time curves, and a high-temperature thermostat. W. E. L. BROWN (J. Sci. Instr., 1939, 16, 195—199).—The thermopile consists of 8 differential Pt-(Pt-13% Rh) thermocouples, one set of junctions being in contact with 0.1 g. of alloy in a SiO<sub>2</sub> tube. It is enclosed in a thermostatic furnace, the windings of which form a resistance thermometer circuit.

D. F. R.

Registering microphotometer. C. S. BEALS (Month. Not. Roy. Astr. Soc., 1936, 96, 730— 736; Chem. Zentr., 1936, ii, 4145).—Simultaneous recording of the unknown and two comparison spectra is effected with three independent photo-cellgalvanometer systems. A. J. E. W.

Devices for visual comparison of spectrograms. G. E. DAVIS (Science, 1939, 89, 229-230). L. S. T.

Refraction method for obtaining photographic records of concentration gradients. K. J. I. ANDERSSON (Nature, 1939, 143, 720-721).—A method for obtaining photographic records of ngradients in a column of solution, *e.g.*, in a centrifuge cell, is described and compared with Philpot's method (A., 1938, I, 215). L. S. T.

Direct determination of crystal structure from X-ray data. M. AVRAMI (Z. Krist., 1939, 100, 381-393; cf. A., 1938, I, 559).—A detailed mathematical account of work reported. In the procedure, designed to obviate phase difficulties of the "trial and fluke" method in crystal analysis, the experimental relations of at. scattering factors are applied to obtain a simplified system of equations, procedures for solving which are indicated. The method, illustrated from the known  $\rm KH_2PO_4$  structure, has advantages over that of Patterson (A., 1935, 1193). I. McA.

Magnetic electron microscope of high resolving power. A. PREBUS and J. HILLIER (Canad. J. Res., 1939, 17, A, 49—63).—The development of the electron ultramicroscope, its resolving power, and its applications are discussed. An instrument capable of resolution to 200 A. is described. J. W. S.

Effect of chromatic error on the electronmicroscope image. J. HILLIER (Canad. J. Res., 1939, 17, A, 64—69).—By photo-micrometer methods it has been shown that, owing to chromatic error, the intensity-distribution in the image of the edge of a diatom obtained with an electron ultramicroscope has a max. just outside and a min. just inside the image of the edge of the absorbing object. It is suggested that the intensity-distribution curve can be used in physical analysis. J. W. S.

Semi-automatic, multiple, electrometric titration apparatus. M. E. STANSBY and G. A. FITZGERALD (Ind. Eng. Chem. [Anal.], 1939, 11, 290—293).—An arrangement by means of which 10 electrometric titrations can be carried out simultaneously by one operator within a time little > that required for a single titration is described. The burettes are controlled by solenoids, and the progress of titration is followed by a series of coloured lights on a control panel. The apparatus is designed primarily for fish-freshness titrations, but can be used for a wide range of potentiometric work. L. S. T.

Low-resistance glass electrode. W. C. JOHNSON (Chem. and Ind., 1939, 573—574).—The electrode consists of a bundle of glass tubes (diameter  $\sim 1$  mm., thickness 0.05—0.1 mm.) sealed at one end, and cemented together near their open ends. The bundle is sealed into a glass adaptor. Low resistance is thus achieved by increasing the glass surface. A convenient form of Hg<sub>2</sub>Cl<sub>2</sub> half element for use with this and other glass electrodes is described. L. S. T.

Scientific foundations of polarography. M. VON STACKELBERG (Z. Elektrochem., 1939, 45, 466— 491).—A comprehensive account of the electrochemical principles affecting the dropping Hg electrode and its numerous applications as an analytical method. J. A. K.

Potentiometer for measuring voltages of 10 microvolts to an accuracy of 0.01 microvolt. R. P. TEELE and S. SCHUHMANN (J. Res. Nat. Bur. Stand., 1939, 22, 431-439).—Special arrangements for eliminating extraneous thermal p.d. are described. F. J. G.

Wilson cloud chamber with several expansions per second. H. BRINKMAN (Physica, 1939, 6, 519—528).—The gas in a disc-shaped chamber is alternately compressed and expanded by a piston at 0.7—20 cycles per sec., non-turbulent radial motion being secured by means of a baffle plate. During each compression the ions are removed by an electric field. L. J. J.

Cathode-ray tube unit. ANON. (J. Sci. Instr., 1939, 16, 199—200).—The unit has a deflexion sensitivity of 0.18 mm. per v. for the x-plates and 0.28 mm. per v. for the y-plates and is suitable for use at all frequencies up to those corresponding with ultra-short radio waves. D. F. R.

Chemical studies by means of molecular beams. VII. Measurement of atomic beams of potassium by means of an incandescent tungsten surface. I. K. KODERA (Bull. Chem. Soc. Japan, 1939, 14, 114—121).—Taylor's method (A., 1929, 1212) has been adapted by using a narrow ribbon of W instead of wire. The ions are ejected by electrical flashing and measured by a ballistic galvanometer. The efficiency of the method has been studied.

T. H. G.

Accurate pipette calibrator and microaspirator. E. E. OSGOOD, A. H. OSGOOD, and E. S. WEST (Amer. J. clin. Path., Tech. Suppl., 1939, 3, 128-133). C. J. C. B.

Glass helices for packing laboratory fractionating columns. R. W. PRICE and W. C. MCDERMOTT (Ind. Eng. Chem. [Anal.], 1939, 11, 289—290).— Apparatus and method for making uniform spirals up to 35 cm. long from Pyrex glass rod are described. L. S. T.

Laboratory columns for close fractionation. Conical type of Stedman packing. L. B. BRAGG (Ind. Eng. Chem. [Anal.], 1939, 11, 283-287).— Further developments of the Stedman type of packing in three sizes are described. Efficiency test-data for a mixture of  $C_6H_6$  and  $C_2H_4Cl_2$  are recorded. Efficiency is highest at low rates of distillation; a max. is reached at a point below which efficiency decreases rapidly with further reduction in the rate. L. S. T.

Determination of interfacial tension by measurement of equilibrium rotation surfaces. H. FLOOD and H. WERGELAND (Kong. Norske Vidensk. Selsk. Forh., 1936, 8, 125—127; Chem. Zentr., 1936, ii, 4101).—The interfacial tension is deduced from the form of a drop of liquid in a horizontal tube full of the second liquid, and in rapid rotation about its axis. A. J. E. W.

Gasoline-torch laboratory burner. J. J. LYNCH (Science, 1939, 89, 230). L. S. T.

Anti-foaming devices. R. SCHNURMANN (Ind. Eng. Chem. [Anal.], 1939, 11, 287–288).—Of two methods of destroying the large bubbles on the liquid surface, one applies an intermittent electric spark over the bubbles, and the other a weak jet of air or other gas across the mouth of the flask containing the foaming liquid. (Cf. B., 1939, 789.) L. S. T.

Mechanical stirrer. C. F. KREWSON (J. Chem. Educ., 1939, 16, 138-139). L. S. T.

Simple vibrator. J. F. VINCENT and M. M. SPRUIELL (Ind. Eng. Chem. [Anal.], 1939, 11, 247).— A rotating glass stirrer with a rubber-covered projection is set at an angle and strikes the lower end of one of a series of absorption tubes. L. S. T.

Apparatus for ultrafiltration. A. BAUDOUIN and J. LEWIN (Compt. rend. Soc. Biol., 1939, 130, 599—602).—The apparatus, which may be sterilised and used at various temp., consists of a porous glass disc which supports the collodion membrane, the filtration being conducted under pressure.

H. G. R.

Liquid-flow regulator and its application to a constant-rate gas sampler. J. R. C. DUKE (J.S.C.I., 1939, 58, 231-232).—A liquid-flow regulator which operates on the principle of the Edwards gas-regulating bottle has been devised. Small errors, due to

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displacement of Hg, have been eliminated by the insertion of a sintered-glass diaphragm which is permeable to  $H_2O$  but not to Hg. The regulator has been used in the construction of a const.-rate gas sampler.

Generator for air-free carbon dioxide (or hydrogen). S. H. TUCKER (Analyst, 1939, 64, 410-415).—The construction of the apparatus, the prep. of air-free reagents, and the manipulation and testing of the generator are described. E. C. S.

Technique of working with liquefied gases. V. A. PLESKOV (J. Phys. Chem. Russ., 1938, 12, 255— 258).—(1) A const. level for liquid NH<sub>3</sub> in a cryostat may be secured by placing electrodes below and just above the surface; when the current between these electrodes is interrupted another current which causes an addition of NH<sub>3</sub> is switched on. (2) A good filling for U-tubes for drying NH<sub>3</sub> etc. is obtained by wetting glass splinters with a solution of K in NH<sub>3</sub> and boiling off NH<sub>3</sub>. (3) An extraction apparatus for liquid NH<sub>3</sub> is described. J. J. B.

Simple apparatus for demonstrating Boyle's law. E. E. HAYS and R. G. GUSTAVSON (J. Chem. Educ., 1939, 16, 115). L. S. T.

Apparatus for holding funnels while filtering into beakers. E. SWIFT, jun. (J. Chem. Educ., 1939, 16, 120).—A small glass or metal hook bent to fit over the rim of a beaker holds the funnel securely against the side of the beaker. L. S. T.

Uni-directional source of ultrasonic waves. J. GRUETZMACHER (Z. tech. Physik, 1936, 17, 166– 167; Chem. Zentr., 1936, ii, 932).—Internal reflexion of waves on one face of the piezo-electric crystal is effected by attaching an air reservoir; the available energy is thus conc. in one direction through the liquid medium. A. J. E. W.

"Coleum Philosophorum " of Philipp Ulstad. E. R. ATKINSON and A. H. HUGHES (J. Chem. Educ., 1939, **16**, 103—107).—Historical. L. S. T.

Methods of fire-making used by early man. W. N. WATSON (J. Chem. Educ., 1939, 16, 107; cf. A., 1939, I, 225).—A correction. L. S. T.

resolution to 200 A: Is described, ...

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Ocean water from various parts of the world. T. NISHIKAWA, T. OKUNO, M. MAEDA, and Y. OGATA (J. Soc. Chem. Ind. Japan, 1939, 42, 71—72 в).— Analyses of sea-H<sub>2</sub>O taken at different places and seasons are presented. Although the total concn. of salt is variable the proportions of the constituents are substantially const. W. A. R.

Occurrence of boron in salt lakes of Aral-Kaspian region. I. B. FEIGELSON, M. G. VAL-JASCHKO, and A. G. BERGMAN (Compt. rend. Acad. Sci. U.R.S.S., 1939, 22, 244—247).—Data showing the B content of 64 lakes are tabulated. L. S. T.

Metamorphism of the subterranean waters of Levshino. A. M. KUZNETZOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, 22, 248-253).—Waters differing in composition and mineralisation have been found at the same level. Waters of the same type also occur in rocks lithologically different. At a depth of 40— 50 m., CaCl<sub>2</sub> and Mg brines with a high content of K, Br, and I are also found. The waters are classified into (i) Ca(HCO<sub>3</sub>)<sub>2</sub> waters with mineralisation up to 0.5 g., (ii) CaSO<sub>4</sub> waters, 0.5—5.0 g., (iii) Na<sub>2</sub>SO<sub>4</sub> waters, 5.0—25.0 g., and (iv) chloride waters with mineralisation >25 g. per l. Waters of lower zones contain H<sub>2</sub>S >0.3400 g. per l. The temp. of the waters varies from 2° to 6°. Chemical analyses are recorded. Changes in composition in the solutions as dependent on mineralisation are discussed. L. S. T.

Spectroscopic character of the thermæ of the Transilian Alatau (Tyan-Shan). I. P. KovoCHATSKI and S. K. KALININ (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 323—324).—Qual. analyses have been made of the dry residues of 16 springs of the Alma-arasan, Talgar, and Gorelnik groups. All contain Mo, which is also found in local minerals. The following elements have been recognised : Cu almost always; B, Fe, Al, Li, and Sr frequently; Pb and Zn occasionally. Ni is characteristic of the Talgar group. T. H. G.

The Salinas grandes of Cordoba province [Argentina]. R. RIGAL (Bol. Acad. Nac. Cienc., 1938, 34, 142—182).—A no. of specimens of the contents of salt lakes and deposits in the region have been analysed. The NaCl content varies from 90.76to 99.70%, and is accompanied by CaSO<sub>4</sub> and Na<sub>2</sub>SO<sub>4</sub>. Analyses of samples of salt from other Argentine, British, German, and Spanish sources are recorded. F. R. G.

Garnet crystals from California. J. MURDOCH (J. Geol., 1939, 47, 189—197).—Numerous large and well-developed crystals of almandite garnet occur in diorite boulders at the San Joaquin Valley, Cal. They are characterised by inclusions of felspar identical with that in the surrounding rock. They are either phenocrysts or were formed by replacement of the diorite shortly after its intrusion into a series of metamorphosed sediments. L. S. T.

Gold, pyrite, and carbon in the Rand banket. M. S. FISHER (Bull. Inst. Min. Met., 1939, No. 414, 36 pp.).—On the basis of microscopical examination of sections of the Rand banket the manner of occurrence of the Au, C, pyrite and other sulphides is discussed; all appear to have been deposited from solution in a definite order. It is concluded that the conglomerates have been subjected to extensive hydrothermal action which has brought about various changes in the rocks and the minerals, and that the bulk of the Au was deposited at a late stage in these changes. Microscopical evidence is in accordance with the view that the Au was introduced hydrothermally, but it can also be reconciled fairly well with the assumptions of the modified placer theory which appears to account best for the geo-A. R. P. logical data.

Synthesis of anorthite by pneumatolysis using shattering explosives. A. MICHEL-LEVY and J. WYART (Compt. rend., 1939, 208, 1030–1033; cf. A., 1939, I, 287).—Anorthite has been synthesised by detonation of a mixture of hexogen (1.5), SiO<sub>2</sub> (0.12),  $Al_2O_3$  (0.05), and CaCO<sub>3</sub> (0.08 g.), followed by annealing at 510–560° for 4—7 days. Two specimens are illustrated and described, the effect of longer annealing at higher temp. being studied.

A. J. E. W.

Synthesis of quartz by pneumatolysis.—See A., 1939, I, 427.

Schluckenau nickel-copper ore. V. PAIS-TOUPIL (Chem. Obzor, 1936, 11, 42-46; Chem. Zentr., 1936, ii, 2875).—The ore (Ni 0.4-2.5, Cu 0.7-3.66%) is a diabase with included pyrrhotine, and can be worked up by flotation. A. J. E. W.

Volcanic rocks from Turkana, Kenya Colony: their field occurrence. W. C. SMITH (Quart. J. Geol. Soc., 1938, 94, 507—553).—The rocks described include rhyolites, trachytes, phonolites, tephrites, trachybasalts, basalts, basanites, and nephelinites. Five chemical analyses [M. H. HEV] of basalt lavas and lapilli from the Teleki and Likaiyu volcanoes are recorded. L. S. T.

Ilmenite-hæmatite-magnetite relations in some emery ores. J. M. BRAY (Amer. Min., 1939, 24, 162-170).-Ores from Naxos, Greece, from Whittles, Virginia, from Chester, Mass., from Macon Co., N. Carolina, and from Peekshill, N.Y., are described. The chief method of occurrence of hæmatite (I) and ilmenite (II) is in the form of unique exsolution intergrowths, indicating unusual conditions of crystallisation. (II) exsolves from (I) to sharp magnetite (III)-(I) boundaries, showing that (I) is primary and not a later replacement product of (III). Exsolution of (I) from corundum is also well-defined. The original solid solution varied in composition from dominant (I) to dominant (II). L. S. T.

Rutile in the Dogger [of N.-E. Yorkshire]. R. H. RASTALL (Geol. Mag., 1939, 76, 109–115; cf. A., 1939, I, 109).—The many different varieties of rutile (I), which show a wide range of colour including green, are described. Unlike the brookite and anatase, the (I) is never authigenic. L. S. T.

Chemical and mineralogical study of a new titanium mineral from Nellore District. N. JAYARAMAN and K. R. KRISHNASWAMI (Quart. J. Geol. Soc., India, 1938, 10, 97—108).—The magnetic black inclusions (photomicrographs reproduced) in the garnets of the schist complex of Nellore (cf. A., 1937, I, 270) consist of a mineral containing SiO<sub>2</sub> 0·12, TiO<sub>2</sub> 65·90, FeO 18·88, Fe<sub>2</sub>O<sub>3</sub> 15·27, total 100·17%; it is probably a member of the system FeTiO<sub>3</sub>-TiO<sub>2</sub>-Fe<sub>3</sub>O<sub>4</sub>. The mineral is sol. in cold, conc. HCl. L. S. T.

Petrography of some S. Victoria Land rocks. D. STEWART, jun. (Amer. Min., 1939, 24, 155—161).— The mineralogical compositions of numerous rocks from S. Victoria Land, Antarctica, are tabulated and discussed. The 15 intrusive rocks vary in composition from kalialaskite to meladiorite. Small quantities of cassiterite in a kalialaskite provide an uncommon feature. L. S. T.

Germanium, gallium, and indium in Sardinian blendes. S. C. L. CAMBI and L. MALATESTA (Rend. Ist. Lomb. Sci. Lett., 1936, [ii], 69, 369– 374; Chem. Zentr., 1936, ii, 3645).—Montevecchio Zn blendes contain In 0.007-0.012 (0.035-0.08), Ge 0.009-0.016 (0.03-0.06), and Ga 0.015-0.03(0.07-0.15%). Electrolytic residues gave the contents in parentheses. A. J. E. W.

Arrangement of atoms in laurionite, PbOHCl. S. GOLDSZTAUB (Compt. rend., 1939, 208, 1234— 1236; cf. A., 1937, I, 334).—The co-ordinates of Pb (0·21, 0·088, 0·25), Cl (0·46, -0.174, 0·25), and OH (-0.16, 0·088, 0·25) are derived, using data from a Fourier analysis along the [010] axis. The structure consists of Cl(PbOH)<sub>2</sub>Cl layers parallel to the  $g^1$ (010) cleavage; each Pb atom is surrounded by three Cl atoms (distances 3·13, 3·15) and three OH groups (2·64, 2·66 A.), the nearest Cl atom in the neighbouring layer being at a distance of 3·52 A. A. J. E. W. Density of the pure potash-felspar constituent in microcline, and its general chemical composition. E. ROTTENBACH (Zentr. Min., A, 1936, 23—239; Chem. Zentr., 1936, ii, 3894).—Microcline has d 2.557(9); it is an alkali felspar, but not a pure potash felspar. A. J. E. W.

X-Ray examination of some potash-sodafelspars. S. H. CHAO, D. L. SMARE, and W. H. TAYLOR (Min. Mag., 1939, 25, 338-350).—The samples of microperthic felspars previously examined chemically, optically, and thermally (A., 1937, I, 269; 1938, I, 542) have been examined by X-ray methods. In their normal state, when showing the microperthic structure with a schiller reflexion, they consist of two closely related materials, one of potash-felspar being monoclinic, and the other of most of the soda-felspar being triclinic but different from ordinary albite. The heat-treated specimens show only a single structure. The cell dimensions vary with the amount of soda-felspar present.

L. J. S.

Existence of a monoclinic soda-felspar, T. Iro (Z. Krist., 1938, 100, 297—307; cf. A., 1937, I, 383). —Analysis of oscillation, Sauter, and Weissenberg X-radiograms for moonstone from Korea refutes views that it is a submicroscopically twinned triclinic felspar or an intergrowth of triclinic albite with monoclinic orthoclase. It consists of sanidine submicroscopically intergrown with an isomorphous Na monoclinic felspar of which the cell elements (a 7.94, b12.90, c 7.12 A.,  $\beta$  116°) account for the confusion with albite. I. McA.

Blue fluorescence of natural silicates in the ultra-violet, and experiments with synthetic silicate melts containing bivalent europium. H. HABERLANDT and A. KÖHLER (Naturwiss., 1939, 27, 275).-Potash-felspar, potash-soda-felspar, and datolite (KCaBSiO<sub>5</sub>) give a blue fluorescence in the filtered ultra-violet from a quartz Hg-vapour lamp. The phenomenon is ascribed to the presence of traces of Eu<sup>II</sup>. This was verified by preparing synthetic silicates of the above composition with the addition of traces of Eu<sup>II</sup>.  $2.5 \times 10^{-4}$  g. of Eu<sup>II</sup> per g. of synthetic felspar gives a fluorescence considerably brighter than that given by the natural product, or than that of a natural fluorite known to contain 10<sup>-4</sup>—10<sup>-3</sup> g. of Eu<sup>II</sup> per g. A felspar with a standard [Eu<sup>II</sup>] was used to determine the [Eu<sup>II</sup>] of other minerals by visual comparison of the brightness of the filtered fluorescence emission. A potash-felspar from Echsenbach was found to contain 10<sup>-6</sup> g. Eu<sup>II</sup> per g. An improved photometric method of determining the brightness of the fluorescence was also used to determine traces of Eu<sup>II</sup> (~10<sup>-9</sup> g. per g. of mineral) in natural silicates. The use of fluorescence analysis of various felspars in the solution of geochemical and petrogenetic problems is also discussed. A. J. M.

Luminescence in the mineral kingdom. M. DÉRIBÉRÉ (Ann. Chim. Analyt., 1939, [iii], **21**, 119— 124, 145—152).—A review and bibliography. A. R. PE.

Identity of Inder ascharite and camsellite. T. N. AGAFONOVA and E. W. ISKÜLL (Compt. rend. Acad. Sci. U.R.S.S., 1939, 22, 325–326).—Inder ascharite has the same composition  $(2MgO,B_2O_3,H_2O)$ and the same n ( $\alpha = 1.575\pm0.003$ ;  $\beta$  not measured;  $\gamma = 1.649\pm0.003$ ) as camsellite, whilst X-ray powder photographs of both show the same glancing angles and relative intensities. The two minerals are therefore identical. Chemical composition and recorded physical properties suggested that szaibelyite is also identical with them but X-ray data are lacking. Although of similar composition Stassfurt ascharite has different optical properties. T. H. G.

Synthesis of inderite. I. B. FEIGELSON, V. E. GRUSCHVITSKI, and T. V. KOROBOTSCHKINA (Compt. rend. Acad. Sci. U.R.S.S., 1939, 22, 242—243).—A solution of 210.3 g. of Na<sub>2</sub>B<sub>4</sub>O<sub>7</sub>,10H<sub>2</sub>O, 157.5 g. of MgSO<sub>4</sub>,7H<sub>2</sub>O, and 2632 g. of H<sub>2</sub>O kept at 35° for 52 days gives a cryst. ppt. which, after washing with H<sub>2</sub>O and EtOH, has the composition and optical properties of inderite, 2MgO,3B<sub>2</sub>O<sub>3</sub>,15H<sub>2</sub>O.

L. S. T. Zunyite and zunyite rock of Karabas. K. I. ASTASCHENKO and V. A. MOLEVA (Compt. rend. Acad. Sci. U.R.S.S., 1939, 22, 327-330).—A mineral identified as zunyite, found in a vein enclosed in diaspore-sericite secondary quartzites, has SiO<sub>2</sub> 25:53, TiO<sub>2</sub> 0:62, Al<sub>2</sub>O<sub>3</sub> 57:42, Fe<sub>2</sub>O<sub>3</sub> 0:10, MnO traces, MgO 0:03, CaO 0:10, SrO 0:001, Na<sub>2</sub>O 0:17, K<sub>2</sub>O 0:11, P<sub>2</sub>O<sub>5</sub> 0:56, Cl 2:56, F 5:52, H<sub>2</sub>O+ 10:03, H<sub>2</sub>O- 0:12 %. It is colourless and in some specimens has very low birefringence (0:002) and straight extinction, but is isotropic in others;  $n 1:587-1:594\pm0:002$ . Goniometrically it appears to be cubic. T. H. G.

Dolomites and flints in the phosphatic shale formation of the Hodna (Constantine). L. CAYEUX (Compt. rend., 1939, 208, 1541—1543).—The occurrence of dolomite and flints in association with phosphates is described, and conclusions are reached concerning the genesis of the deposits. A. J. E. W.

Mineralogical nature of some North African minerals; X-ray study. L. ROYER (Compt. rend., 1939, 208, 1591—1593).—Pisolites deposited from hot springs (95°), and from Carlsbad, are shown by Xray examination to consist of aragonite. Specimens from cooler springs (63°) are composed of calcite. If a third polymorphic form of CaCO<sub>3</sub> occurs during formation of pisolites, this must undergo rapid transformation into aragonite or calcite. North African kieselguhrs consist of amorphous hydrated SiO<sub>2</sub>; tridymite can be detected after heating at >1000°. SiO<sub>2</sub> in petrified wood occurs as quartz. Various forms of North African phosphates give apatite X-ray diagrams. A. J. E. W.

Heavy mineral assemblages of the Burma oilfields. S. KRISHNASWAMY (Quart. J. Geol. Soc., India, 1938, 10, 109—121).—The more important heavy minerals are magnetite, ilmenite, hornblende, epidote, garnets, zircon, rutile, chloritoid, kyanite, sphene, tourmaline, staurolite, tremolite, zoisite, and glaucophane. The last six are accessory minerals. The Irrawadian series shows predominant hornblende, rutile, and zircon, whilst the Pegus series shows predominant garnets and epidote. Staurolite occurs in many samples; brookite and anatase are rare. L. S. T.

Geology of Jamkhandi, Deccan. Y. T. APTE (Quart. J. Geol. Soc., India, 1938, 10, 123-133). L. S. T.

Geology of Vengurla Peta. B. G. DESHPANDE (Quart. J. Geol. Soc., India, 1938, 10, 167—178).— Rocks and minerals of the Archaean group, the Kaladgi sediments, and the Deccan trap are described. Two chemical analyses of Vengurla granite-gneiss are recorded. L. S. T.

Action of minerals on gold solutions. O. E. ZVJAGINTZEV and I. A. PAULSEN (Compt. rend. Acad. Sci. U.R.S.S., 1938, 21, 176–178).—The action of aq. AuCl<sub>3</sub> on PbS,  $FeS_2$ , chalcopyrite, sphalerite, and FeAsS, and of aq. NaAuO<sub>2</sub> on PbS, sphalerite, and FeS<sub>2</sub> has been studied and the reaction products have been analysed. Au is produced in all cases, and S in several. The geochemical significance of the reactions is discussed. E. S. H.

Beryllium-bearing variety of allanite. T. IIMORI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, 36, 53—55).—A mineral with a pitch-black lustre has been found at Iisaka village, Daté County, Fukushima Prefecture. It exists in massive anhedral form and has a greenish-grey streak;  $\rho$  3.67; hardness 5—6; weakly radioactive. Its composition is SiO<sub>2</sub> 30.58, Al<sub>2</sub>O<sub>3</sub> 12.71, rare earths 23.94, ThO<sub>2</sub> 0.26, ZrO<sub>2</sub> 0.57, Fe<sub>2</sub>O<sub>3</sub> 5.74, FeO 10.81, MnO 2.05, BeO 2.49, CaO 8.20, UO<sub>3</sub> trace, H<sub>2</sub>O+ 3.33%. It appears to be an allanite with a much higher Be content than usual. This may be the result of weathering, as Al<sub>2</sub>O<sub>3</sub> and BeO usually survive the weathering of allanite. T. H. G.

Intercalibration and comparison in two laboratories of measurements incident to the determination of the geologic ages of rocks. R. D. EVANS, C. GOODMAN, N. B. KEEVIL, A. C. LANE, and W. D. URRY (Physical Rev., 1939, [ii], 55, 931—946).— Results based on the accumulation of He in igneous rocks showed disagreement with available data. A cooperative revision showed that the Ra determinations used in the previous He time scale were incorrect. Full revised data by the  $\alpha$ -He method and the Rn– Th–He method are given and complete agreement is now obtained. N. M. B.

Linarite in ore deposits of Kazakhstan. F. V. TSCHUCHROV (Compt. rend. Acad. Sci. U.R.S.S., 1939, 22, 257—258).—Linarite (I) has been recognised in the deposits at Dzhezkazgan, Azhim, Berkar, and Manka. (I) from the first locality contains PbO 47·15, CuO 26·43, SO<sub>3</sub> 20·70, H<sub>2</sub>O 5·00, insol. residue (quartz) 1·22, total 100·50% [V. M. SENDEROVA], giving the formula (Cu,Pb)SO<sub>4</sub>,(Cu,Pb)(OH)<sub>2</sub>. Modes of occurrence and associated minerals are described.

L. S. T. Mercury in barytes. A. A. SAUKOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, 22, 254—256).— The Hg contents, determined spectrographically and nephelometrically, of numerous deposits of barytes in the U.S.S.R. range from  $1.9 \times 10^{-2}$  to  $2.4 \times 10^{-5}\%$ . Chkalovite. V. I. GERASIMOVSKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, 22, 259–263).—*Chkalovite* (I),  $\rho$  2.662, hardness ~6,  $n_g$  1.549,  $n_p$  1.544, orthorhombic, occurs as white semi-transparent grains of vitreous lustre in the Lovozero alkaline massifs of the central part of the Kola peninsula. X-Ray diagrams and plane spacings are given. (I) is sol. in cold, dil. or conc. HCl or HNO<sub>3</sub>, with separation of flaky SiO<sub>2</sub>, nH<sub>2</sub>O. The analysis [PEREVERZEVA] SiO<sub>2</sub> 56.81, Fe<sub>2</sub>O<sub>3</sub> 0.30, FeO 0.12, BeO 12.67, CaO 0.37, Na<sub>2</sub>O 28:93, K<sub>2</sub>O 0.13, H<sub>2</sub>O — 0.23, SO<sub>3</sub> 0.22, total 99.78% indicates a formula Na<sub>2</sub>O, BeO, 2SiO<sub>2</sub>. The modes of occurrence and accompanying minerals, many of which contain traces of Be, are described. L. S. T.

Alkaline earth. I. K. KAWASE, H. KA, and K. KAWAKAMI (J. Agric. Chem. Soc. Japan, 1939, 15, 459—472).—The earth in the alkaline district of North Manchuria, from which edible salt or "earth salt" is prepared by extraction with  $H_2O$ , filtration, and evaporation, contains approx. 25% of  $H_2O$ -sol. material. The latter contains 62—99% of Na<sup>\*</sup>. The amounts of Cl', SO<sub>4</sub>", CO<sub>3</sub>", and HCO<sub>3</sub>' vary with external conditions. The deposits near the lake contain more Cl' than SO<sub>4</sub>" and considerable amounts of NO<sub>3</sub>' and NO<sub>2</sub>'. J. N. A.

Manganese and gold deposits in the lower and middle Barama River of North-West District, British Guiana. D. A. B. DAVIES (Bull. Imp. Inst., 1939, 37, 245-251).

History of "Widmanstätten" structure. M. H. HEY (Nature, 1939, 143, 764).—Widmanstätten's discovery of etch figures on meteoric Fe was anticipated by W. Thomson by several years (Atti Accad. Sci. Siena, 1808, 9, 37). L. S. T.

Presence of less common elements in rocks. J. N. FRIEND and J. P. ALLCHIN (Nature, 1939, 143, 762).—Ni has been detected in dark green inclusions in calcites from Cannington Park, near Bridgwater, and from Weston-super-Mare. The former also contains V. Te has been detected in the insol. residue left after digesting S from Krisuvik, Iceland, with  $CS_2$ . L. S. T.

Tin-bearing deposits of Canali Serci (Villacidro; Iglesias). P. PIEPOLI and N. COLLARI (Period. Min., 1936, 7, 147—169; Chem. Zentr., 1936, ii, 1510).—The deposits (which are of pneumatolytichydrothermal origin) consist chiefly of Zn blende, galena, and pyrites, with marcasite, pyrrhotine, chalcopyrite, tetrahedrite, and cassiterite. The Sn content is > a few %. A. J. E. W.

Transformation of pyroxene-peridotites into rocks containing a predominance of silica and iron in the basin of Lulua and Bushimaie. E. POLINARD (Publ. Congo belge Régions vois., 1936, 59, 19—33; Chem. Zentr., 1936, ii, 1139).—Serpentine is formed by weathering of the Mg minerals, and chalcedony, quartz, opal, oligoclase, and magnetite are produced by removal of all the MgO and part of the FeO, Al<sub>2</sub>O<sub>3</sub>, and CaO. A. J. E. W. Heavy minerals from the older Upper Bavarian molasse. H. ANDRÉE (Jahrb. Min. Beil.-Bd., 1936, 71, 59—120; Chem. Zentr., 1936, ii, 1139).—A description of the deposits and the associated heavy minerals, consisting predominantly of granite, with zircon, andalusite, tourmaline, etc. The sediments (other than vitreous sands, which are of eruptive origin) are metamorphic. A. J. E. W.

Little-known platinum deposits. F. HERMANN and O. GÜNTHER (Metall u. Erz, 1936, 33, 349-353; Chem. Zentr., 1936, ii, 4202).-Deposits in Beni Schangul and Wollega (Abyssinia), Sierra Leone, Chile, and Brazil are described. A. J. E. W.

Putten mine, Willenberg. An old gold working at Röversdorf, near Schönau, on the Katzbach (Lower Silesia). A. ZÖLLER (Z. pr. Geol., 1936, 44, 109—112; Chem. Zentr., 1936, ii, 4202).—Siliceous schist adjoining quartz porphyry contains auriferous pyrrhotite which was extracted by amalgamation; the deposits are now of doubtful val. A. J. E. W.

Copper ore deposits. I. The Hosenberg mining area. H. SCHNEIDERHÖHN and E. KAUTZSCH (Jahrb. Min. Beil.-Bd., 1936, A, 71, 492—523; Chem. Zentr., 1936, ii, 4201).—A geological and petrographical description of the deposits, which are not of workable val. A. J. E. W.

Angularity of granite quartz. F. SCHMITT (Zentr. Min., 1936, A, 239—243; Chem. Zentr., 1936, ii, 4201).—The condition of quartz cannot be used in comparing transport processes in sediments, as much primary granite quartz has rounded surfaces. Blasiwald granite quartz has angular and rounded surfaces in the ratio 3:7. A. J. E. W.

Chemistry of the weathering process [in alumino-silicate rocks]. R. SCHWARZ (Congr. int. Quim. pura apl., 1934, 9, III, 320-326; Chem. Zentr., 1936, ii, 4104).-Felspar, anorthite, and leucite are converted into kaolin (I) by several days' treatment with 0.5N-HCl at 320°, under pressure.  $CO_{2}$  (190 atm.) is ineffective, as the prokaolin-(I) reaction requires acid conditions; H<sub>2</sub>SO<sub>4</sub> and HF attack the kaolin. Formation of (I) is subsequent to hydrolysis, and occurs only in presence of a sufficient quantity of dissolved  $SiO_2$ ; an equilibrium exists between (I) and the Al and  $SiO_2$  in solution. (I) is always deposited from solutions containing sufficient Al and SiO<sub>2</sub>, and may thus be formed from various Al silicates in an acid medium at high temp. and pressure. Under other conditions the hydrolysis products give allophantones of variable composition, which are decomposed by HCl. Alkaline media give lateritic deposits owing to the stability of alkaline Å. J. E. W.  $SiO_2$  sols.

Electron optical examination of clay minerals. W. EITEL, H. O. MÜLLER, and O. E. RADCZEWSKI (Ber. Deut. Keram. Ges., 1939, **20**, 165–180).— Under magnifications of  $15-27 \times 10^3$  the finest fractions of kaolin contain hexagonal laminæ with characteristic sharp edges and cleavage. On heating no change occurs up to 500–600°, when the edges of the laminæ lose their definition, although the faces remain plane and smooth. It is possible that on dehydration the material decomposes, leaving pseudomorphs of SiO<sub>2</sub> and Al<sub>2</sub>O<sub>3</sub>; at 800—900° these break up into fine particles, from which larger crystals grow again above 1000°. At ~1100—1200° sintering begins. Noll's synthetic kaolin (A., 1937, I, 51) behaved similarly except that the crystals were less uniform, contained traces of raw materials from which they were formed, and the thermal changes occurred at somewhat lower temp. than in the natural product. In pholerite the changes occurred even more readily, perhaps owing to the presence of mineralisers. G. H. C.

Recent methods in mineralogical analysis of clay. W. NOLL (Ber. Deut. Keram. Ges., 1939, 20, 180—200).—A survey is given of recent advances in analytical technique by the following methods: by sedimentation, optical, ultramicroscopical, and X-ray examination; dehydration, heating and cooling curves; differential solubilities in acid; base-exchange and dye-adsorption methods. G. H. C.

Bentonitic clays from Hawke's Bay.—See B., 1939, 604.

Kroehnkite and natrochalcite from Chile. C. PALACHE (Amer. J. Sci., 1939, 237, 447–455).— New material from Chuquicamata has permitted a crystallographic re-examination of these minerals (cf. A., 1908, ii, 1047); a:b:c = 0.4586:1:0.4357and  $\beta$  108° 30';  $\rho$  is corr. to  $2.90\pm0.02$ . X-Ray analysis [W. E. RICHMOND] gives  $a_0:b_0:c_0$ 0.4593:1:0.4359 with  $a_0.5.78, b_0.12.58$ , and  $c_0.5.48$  A.;  $v_0 = 378.01$  A.<sup>3</sup> The formula is 2(CuSO<sub>4</sub>, Na<sub>2</sub>SO<sub>4</sub>, 2H<sub>2</sub>O); space-group  $C_{2h}^{e}$ — $P2_1/C$ . Natrochalcite, Na<sub>2</sub>SO<sub>4</sub>, Cu<sub>4</sub>(OH)<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>, 2H<sub>2</sub>O, has a:b:c =1.4239:1:1.2140,  $\beta$  118° 421′,  $\rho_{obs}$ . 3.476 and  $3.49\pm0.2$ ,  $\rho_{calc}$ . 3.54; CuO 42.01, Na<sub>2</sub>O 7.98, SO<sub>3</sub> 42.42, H<sub>2</sub>O 7.71% [F. A. GONYER]. X-Ray analysis [W. E. RICHMOND] gives  $a_0$  8.74,  $b_0$  6.15,  $c_0$  6.53 A.,  $\beta$  118° 421′; space-group  $C_{2h}^{s}$ —C2/m. L. S. T.

Occurrence of titanium and nickel in coal.— See B., 1939, 566.

Geology of the area north of Contact Lake, N.W.T., Canada. G. M. FURNIVAL (Amer. J. Sci., 1939, 237, 476-499).—Mineralogical analyses of meta-argillite, granodiorite, biotite granite, metamorphosed granodiorite, and quartz-enstatite diabase are recorded and discussed. L. S. T.

Isotopes of potassium in phosphate rocks and salts. A. K. BREWER (J. Amer. Chem. Soc., 1939, 61, 1597—1599).—Using a small modification of the apparatus of Taylor and Urey (A., 1938, I, 526), the base-exchange method of K isotope separation has been studied for 25 soils and phosphate rocks of different origins. In soils in which K has been largely replaced by base exchange  ${}^{39}K: {}^{41}K$  should be low and a soil of low K content which acquires K from some abundant source should have a high ratio. The predicted effects have been observed. For most soils the ratio is 14-20 (normal val.) but vals. between 13-90 and 14-20 have been found, indicating deviations in K content. W. R. A.