

# BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

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

AUGUST, 1938.

**Axiality of light emission of the hydrogen atom in the electric field.** J. STARK, R. RITSCHL, and H. VERLEGER (*Physikal. Z.*, 1938, **39**, 503—517).—The intensity ratio of the components of the H lines in positive rays under the action of an electric field has been investigated under various conditions. With the exception of the  $\pm 2$  components of  $H_\alpha$  and  $H_\beta$  the long-wave components are more intense than the short-wave when the applied field is in the same direction as the positive rays. This dissymmetry is reversed if the directions of the field and positive rays are opposite. The pressure of gas alters the degree of dissymmetry, and in the case of opposite directions of field and rays the dissymmetry decreases with decreasing pressure. In the case of light emitted when positive rays pass from a space where the gas pressure is about 5 mm. to one where it is very low, the intensity ratios are much smaller, and the dissymmetry is not reversed if the directions of field and rays are opposite. The effect in a transverse field has also been investigated. The polarisation of  $H_\alpha$  is determined under various conditions in both the longitudinal and transverse fields.

A. J. M.

**Light emission and ionisation of the moving state of hydrogen atoms in strong electric fields.** J. STARK and R. RITSCHL (*Physikal. Z.*, 1938, **39**, 517—522).—It is shown that ionisation by collision is rendered more easy under the action of an external electric field in the case of the anodic moving state of the H atom than for the cathodic state. The electric field is not directly responsible for the effect.

A. J. M.

**Detection of negative dispersion in electrically excited helium.** M. KRUSE (*Z. Physik*, 1938, **109**, 312—331).—Negative dispersion in electrically excited He was detected by the "hook" interference method of Roshdestvenski, at several  $\lambda\lambda$  corresponding with  $2s^3S$  and  $2p^3P$  transitions of the He triplet system. A light source emitting a continuous spectrum in the region of 3889 Å. is described. From the results, the approx. increase in packing no. for the states of the He mol. is calc.

H. C. G.

**Spectrum of  $N_2$  and CO in Lyman region.** V. M. TSCHULANOVSKI and S. I. GASSILEVITSCH (*Physikal. Z. Sovietunion*, 1937, **12**, 83—88).—Improvements in the technique of exploring the Lyman region have enabled the resolving power to be increased to 40,000. Preliminary  $\lambda$  vals. for 27 band heads of the CO mol. are given, and the mol. spectrum of  $N_2$  is discussed.

J. A. D.

**Formation and excitation of molecule ions in active nitrogen.** U. STILLE (*Z. Physik*, 1938, **109**,

491—502).—A new theory of the excitation of negative bands in active N (due to Kaplan) is discussed.

L. G. G.

**Atmospheric sodium.** J. CABANNES, J. DUFAY, and J. GAUZIT (*Compt. rend.*, 1938, **206**, 1525—1528; cf. A., 1938, I, 285).—Previous observations are reviewed and discussed. The luminescent layer is  $\sim 130$  km. above the earth's surface, the intensity of the  $D_1D_2$  doublet corresponding with  $2 \times 10^{11}$   $2P \rightarrow 2S$  transitions per sec. per cu. m. The luminescence is attributed to cosmic dusts or meteorites, which may account for the deposition of  $2.5 \times 10^7$  atoms of Na per sec. per sq. m. of the earth's surface. This is in agreement with the appearance of meteorites at an altitude of  $\sim 130$  km. The possibility of attributing certain lines in the night sky spectrum to Ca and Al, which may also have meteoric origin, is suggested.

A. J. E. W.

**Polarisation of the resonance radiation of  $Na_2$  vapour.** P. PRINGSHEIM (*Physica*, 1938, **5**, 489—494).—Observations on a singlet and a doublet series in the Na resonance spectrum, excited at  $320^\circ$  by light from a Cd arc, show that the lines in these series are 40% and 12% polarised, respectively, in fair agreement with theory. Addition of He reduces the degree of polarisation in each case, and causes emission of unpolarised D lines.

A. J. E. W.

**Revision of Al I terms.** R. SCHMID, L. GERÖ, K. LÖRINCZI, and G. NEU (*Nature*, 1938, **141**, 1017).—The seven Al I lines (data given) obtained in spectrograms of an interrupted Al arc are due to a  $4P \rightarrow 4P$  transition and not to a  $2D-2P$  transition (A., 1929, 1206). The term-val. of  $3s3p^2 2D$  must be dropped.

L. S. T.

**Zeeman effect in an anomalous series of argon.** P. JACQUINOT (*Compt. rend.*, 1938, **206**, 1635—1638).—Measurements on lines in the  $p^3ns$  series are recorded. The results are not in agreement with Houston's theory (A., 1929, 480).

A. J. E. W.

**Low terms in Co VI.** I. S. BOWEN (*Physical Rev.*, 1938, [ii], **53**, 889—890; cf. A., 1938, I, 53).—Full data and classifications for about 100 lines and 44 term vals. are tabulated.

N. M. B.

**Quadrupole moment of  $^{83}Kr$  and  $^{131}Xe$  and mechanical moment of  $^{83}Kr$ .** H. KORSCHING (*Z. Physik*, 1938, **109**, 349—357).—From measurements on the Kr I and the Xe I lines in the near infra-red the quadrupole moments of  $^{83}Kr$  and  $^{131}Xe$  are  $0.04 \times 10^{-24}$  and  $\leq 0.03 \times 10^{-24}$  cm.<sup>2</sup>, respectively. The mechanical moment of  $^{83}Kr = 9/2$ . These results are included in a table of all known quadrupole moments to date.

L. G. G.



**Absorption bands of rubidium and caesium in the presence of foreign gases.** N. T. ZE and C. SHANG-YI (J. Phys. Radium, 1938, [vii], 9, 169—170).—In the presence of He, Ne, A, N<sub>2</sub>, and H<sub>2</sub> narrow and diffuse absorption bands appear on the short- $\lambda$  side of the second member of the principal series of Rb and Cs. The position and magnitude of the band depend on the gas employed. The breadth of these bands increases in the order Ne, N<sub>2</sub>, He, H<sub>2</sub>, and for the same gas is greater for Rb than for Cs. The intensity of the band increases with concn. of alkali and of gas. W. R. A.

**Theory of the forbidden mercury line 2655.8 Å.** ( $6^3P_0-6^1S_0$ ). W. OPECHOWSKI (Z. Physik, 1938, 109, 485—490).—The intensity ratios of the components of the hyperfine structure of this line, and the ratio of their total intensity to that of the resonance line 2537 Å., are evaluated. The derived results are in agreement with the conception of interaction between the electron envelope and the nuclear magnetic moment. L. G. G.

**Effect of oxides and impurities on metallic arc reignition.** J. D. COBINE (Physical Rev., 1938, [ii], 53, 911).—Experiments on Cu cathodes confirm the conclusions of Suits (cf. A., 1938, I, 293) on the necessity of oxide on the cathode to establish a stable arc. N. M. B.

**Metallic spectra obtained using shattering explosives.** A. MICHEL-LÉVY and H. MURAOUR (Compt. rend., 1938, 206, 1566—1568; cf. A., 1937, I, 250).—The spectrum of the flash accompanying detonation of a C(NO<sub>2</sub>)<sub>4</sub>-PhMe mixture in a cavity in a metal block contains arc lines and occasionally a few weak spark lines of the metal. Many absorption lines, generally of the non-ionised metal, are also observed in the continuum. A. J. E. W.

**Stark effect on multiple lines.** W. LOCHTE-HOLTGREVEN (Z. Physik, 1938, 109, 358—373).—Tables are given for the relative term displacements of the Stark effect components of multiple lines up to septets; intensities and polarisation of the components are also given. L. G. G.

**Atomic lines in the spectrum of Antares.** D. N. DAVIS (Astrophys. J., 1938, 87, 335—351).—Evidence for the presence of H, Na, Mg, Al, Si, Ca, Ca<sup>+</sup>, Sc, Sc<sup>+</sup>, Ti, Ti<sup>+</sup>, V, V<sup>+</sup>, Cr, Cr<sup>+</sup>, Mn, Fe, Fe<sup>+</sup>, Co, Ni, Cu, Zn, Sr, Sr<sup>+</sup>, Yt, Yt<sup>+</sup>, Zr, Zr<sup>+</sup>, Ru, Ba<sup>+</sup>, La<sup>+</sup>, Ce<sup>+</sup>, Pr<sup>+</sup>, Nd<sup>+</sup>, Sm<sup>+</sup>, Eu<sup>+</sup>, Gd<sup>+</sup>, and Dy<sup>+</sup> from at. lines has been obtained. Line counts and max. intensities are summarised. Mol. data established the presence of B, C, N, O, and F. H lines are excessively strong, and Yt lines strong. The unusual strength of the Ca<sup>+</sup>, Ba<sup>+</sup>, and Sr<sup>+</sup> lines must be due largely to the low surface gravity and the great extent of the atm. of Antares. L. S. T.

**Compton scattering of radiation within a star.** A. B. SEVERNI (Compt. rend. Acad. Sci. U.R.S.S., 1938, 19, 45—48).—Mathematical. The influence of Compton scattering on the total opacity of stellar matter is examined. N. M. B.

**Experimental verification of the quantum mechanical dispersion theory by reflexion and diffuse scattering of X-rays from zinc.** W. A.

BRUCE (Physical Rev., 1938, [ii], 53, 802—806).—The  $F$  vals. obtained in the powder crystal experiments of various investigators, when corr. by the temp. factor given by experiments on diffuse scattering, can be used to verify Hönl's formula for the X-ray scattering power of an atom for  $\lambda\lambda$  near the absorption edge. All existing data on the at. structure factor ( $f$ ) vals. of Zn are in good agreement when corr. by the temp. factor and the Hönl  $\Delta f$ . Full data are tabulated. A set of  $f$  vals. for Zn shows that there is electron distortion, and evidence is given that the distortion of the electron atm. extends deeper into the atom than the valency electrons. N. M. B.

**Laws governing the glowing anodic envelope and their relation to those for the striated positive column in hydrogen and nitrogen.** A. GÜNTHER-SCHULZE, W. BÄR, and H. BETZ (Z. Physik, 1938, 109, 293—309).—The glowing anodic envelope is formed in H<sub>2</sub> under sharply defined discharge conditions, and takes the form of concentric rings or figures consisting of patches of great luminosity. The relation between these figures, c.d., and gas pressure has been measured and the phenomenon is explained in terms of the min. discharge voltage principle. These theoretical considerations led to the experimental production of the phenomenon in N<sub>2</sub>. The relation between the anodic glow and the striations of the positive column is discussed. H. C. G.

**Mode of operation of the hollow cathode.** A. LOMPE (Z. Physik, 1938, 109, 310—311).—The relationship between curvature of the cathode surface, cathode voltage, c.d., and gas pressure is discussed. H. C. G.

**Simple relation in the glow discharge.** Y. KASIWAGI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, 34, 461—476).—From photographs of the steady discharge in N<sub>2</sub> at 0.1—0.5 mm. Hg  $p$  in a cylindrical tube, with various electrodes (121 combinations of 11 metals) and terminal voltages ( $V$ ), the relation  $Bk^2 = V - nu - V_0$  has been established, where  $n$  is the no. of striæ,  $u$  the ionisation potential (16 v.), and  $k$  the distance from cathode to vertex of positive column. The const.  $B$  varies with  $p$  and tube diameter. The const.  $V_0$ , dependent only on the electrode metals, =  $V_C + V_A + \text{const.}$ , where  $V_C$  and  $V_A$  are interpreted as the normal fall in cathode and anode potentials, respectively. Vals. of  $V_C$  are partly confirmed by Rottgardt's data. I. McA.

**Theoretical determination of Townsend coefficient.** S. MORALEV (Physikal. Z. Sovietunion, 1937, 12, 89—104).—The coeffs. of vol. ionisation are calc. theoretically for pure gases and for gas mixtures, taking into account elastic and inelastic collision processes etc. The ionisation coeff. can be represented by  $\alpha = \phi[(E/p), K]$  where  $E$  is the field strength,  $p$  the pressure, and  $K$  the energy losses of the electrons. The variation of  $\alpha$  with the concn. of A in the mixtures A-N<sub>2</sub>, A-Hg, and A-Hg-N<sub>2</sub> has been determined. J. A. D.

**Photo-electric properties of evaporated bismuth films.** A. H. WEBER (Physical Rev., 1938, [ii], 53, 895—899).—Investigations by Du Bridge's method (cf. A., 1932, 209) of Bi films deposited on



glass by evaporation in vac. show that the photoelectric emission and threshold  $\lambda$  increase with film thickness to a limiting val. Good agreement with theory is obtained for the temp. range  $-53.8^\circ$  to  $24.4^\circ$ , but not for higher temp. The measured max. threshold  $\lambda$  was between 2564 and 2600 Å., and the min. val. corresponding with a glass surface thinly spattered with Bi was between 2443 and 2506 Å. Exposure to possible gas contamination showed little effect. N. M. B.

**Evaporation of atoms, ions, and electrons from tungsten.** A. L. REIMANN (Phil. Mag., 1938, [vii], 25, 834—848).—Data are recorded. The present theory of positive-ion emission is regarded as being too simple. A variable surface factor, which has an important effect on ion emission without affecting appreciably electron emission or evaporation, should be taken into account. H. J. E.

**Relation between contact potential and work of escape.** W. HEINZE (Z. Physik, 1938, 109, 459—471).—The contact potentials of W and Ta in vac. were measured and data compared with the work of electron escape derived from the emission equation. Results are in agreement with the theory that the contact potential of two conductors in vac. = difference between their works of electron escape. L. G. G.

**Theory of spiral orbits of the electron in a coulomb field.** J. FRENKEL and J. ROJANSKI (Physikal. Z. Sovietunion, 1938, 13, 181—197).—Mathematical. O. D. S.

**Conception of the corpuscle. Application to heavy electrons.** J. L. DESTOUCHES (Compt. rend., 1938, 206, 1281—1284).—The definition of a corpuscle and the nature of the heavy electron are discussed. A. J. E. W.

**Process of discharge and ionic efficiency in the positive-ray discharge.** C. HAILER (Naturwiss., 1938, 26, 382; cf. A., 1938, I, 222).—Further reference is made to the positive-ray tube as a source of ions for at. transmutation experiments. A. J. M.

**Low-temperature thermal source of Li ions.** H. LU (Physical Rev., 1938, [ii], 53, 845—846).—At temp. as low as  $700^\circ$  amblygonite,  $\text{LiAl}(\text{F},\text{OH})\text{PO}_4$ , emits Li ions, the current obtained being  $>10$  times that from spodumene at  $1000^\circ$ . The time-current curve shows resolution of the  ${}^7\text{Li}$  and  ${}^6\text{Li}$  isotopes, and the emission reaches a max. after about 6 hr. N. M. B.

**Direct evidence for the  $\text{N}_2\text{H}^+$  ion in the discharge reaction between  $\text{N}_2$  and  $\text{H}_2$ .** G. C. ELTENTON (Nature, 1938, 141, 975—976).—Examination by means of a mass spectrograph shows that  $\text{N}_2\text{H}^+$  is produced abundantly when a mixture of  $\text{N}_2 + \text{H}_2$  is bombarded with electrons.  $\text{N}_2\text{H}^+$  appears to owe its origin to  $\text{N}_2^+$  and not to  $\text{H}_2^+$ , and the reaction commences at the ionisation potential of  $\text{N}_2$ . The formation of  $\text{N}_2\text{H}^+$  is only the first stage in the production of  $\text{NH}_3$ . The probability of its formation is  $>$  that of  $\text{H}_3^+$ . L. S. T.

**Formation of negative ions at surfaces.** F. L. ARNOT and C. BECKETT (Nature, 1938, 141, 1011—1012; cf. A., 1938, I, 4, 274, 337).—The negative ion

emitted from a metal surface by bombardment with positive ions need not necessarily be of the same element as the bombarding ion. Five peaks (mass nos. approx. 16, 24, 32, 37, and 44) of light negative ions are obtained by the mass spectrograph when the electrodes are bombarded by positive ions of A, N, or Hg, and the negative ion curves produced by each type of positive ion are practically identical. No negative ions of N are formed. After treatment of the electrode surfaces with  $\text{O}_2$ , bombardment by positive ions of Hg produces  $\text{O}^-$  and  $\text{O}_2^-$ . The peaks reported above probably arise in a similar way from other gases and vapours either occluded in the metal or adsorbed on its surface. L. S. T.

**Improvement of resolving power of mass spectrographs.** R. HERZOG and V. HAUKE (Physikal. Z., 1938, 39, 463—466).—The resolving power of mass spectrographs can be improved by substituting for the slit a diminished image of a slit. This can be done by means of a small radial electric field applied before the usual electric field of the spectrograph. The new conditions for double focussing are given, and an expression for the resolving power is deduced. The advantages and disadvantages of the method are discussed. A. J. M.

**At. wt. of potassium from sunflower seed hulls.**—See A., 1938, III, 631.

**Range of occurrence of stable isotopes.** H. BROWN (Physical Rev., 1938, [ii], 53, 846).—Regularities in the  $A-2Z, Z$  (Harkins) diagram are discussed, and 23 stable undiscovered isotopes are predicted. N. M. B.

**Relation between atomic number and isotopic number for stable isotopes.** G. E. GIBSON and H. BROWN (Physical Rev., 1938, [ii], 53, 846; cf. preceding abstract).—Curves for  $A-2Z, Z$  for all stable isotopes and for all odd and even vals. of the isotopic no. amplify the regularities previously discussed. N. M. B.

**Quantum reactions in the biological action of rays.** K. SOMMERMEYER (Z. Physik, 1938, 109, 332—340).—The definition of collision no. and its relation to  $\lambda$  and half dose val. in biological radiation reactions are considered theoretically. H. C. G.

**Preliminary measurements of the heat produced by the internal deformation of a block of lead influenced by its own weight.** W. ŚWIĘTOŚLAWSKI, L. KEFFLER, and J. SALCEWICZ (Bull. Acad. Polonaise, 1937, A, 546—554; cf. A., 1932, 137; 1934, 623, 748, 938; 1937, I, 478).—The micro-calorimetry of long-lasting processes (e.g., radiology) is discussed, with special reference to the spontaneous heat produced in a suspended block of Pb due to its deformation over 20 days. I. MCA.

**Electric effluvia, atmospheric aerosol, and the measurement of the radioactivity of the atmosphere.** G. ALIVERTI (Nuovo Cim., 1938, 15, 66—67).—The method of measuring atm. radioactivity previously described (A., 1932, 926) is discussed further. O. J. W.

**Internal conversion of electrons of actinon.** W. E. BENNETT (Proc. Camb. Phil. Soc., 1938, 34,



282—289).—The energies of the secondary  $\beta$ -rays arising from actinon by internal conversion have been measured by the cloud chamber method. The internal conversion coeffs. were in agreement with the previous experimental vals. Tracks of Auger electrons associated with the secondary electrons were found. F. J. L.

Formation of positron-electron pairs by  $\gamma$ -radiation. K. ZUBER (Helv. Phys. Acta, 1938, 11, 207—218; cf. A., 1937, I, 437).—The formation of positron-electron pairs in A by means of  $\gamma$ -rays from radio-Th has been studied using an automatic Wilson chamber. Pairs probably due to  $\gamma$ -radiation of energies 1.7—2.1 and 3.0—3.4 M.e.v. are observed, the latter corresponding with 9 quanta per 100 quanta of 2.62 M.e.v. The mean energy difference between the positrons and electrons, and the distribution of the angles between the  $\gamma$ -rays and the electron and positron trajectories, are in accord with the Bethe-Heitler theory (A., 1934, 1150).

A. J. E. W.

Angular distribution of pairs in krypton. L. V. GROSHEV and I. M. FRANK (Compt. rend. Acad. Sci. U.R.S.S., 1938, 19, 49—54).—The angular distribution of pair components was investigated by stereocomparator determinations of the spatial position of the vertex of the pair, of one point on the electron track, and of one on the positron track. Results are tabulated and discussed. N. M. B.

Efficiency of neutron production by deuterium canal-rays. W. DE GROOT and F. M. PENNING (Physica, 1938, 5, 512—519).—The effective cross-sections,  $\sigma$ , for D, Li, Be, and C, as a function of the velocity  $v$  of impinging deuterons, are derived, using previous experimental data (A., 1937, I, 438). It is found that  $\sigma \propto v^m e^{\gamma}$ , where  $0 > m > -2$  and  $\gamma = 2\pi z e c / 137v$  ( $z$  being the no. of unit charges on bombarding particles of mass  $Z$ ). Using this formula the neutron yields have been extrapolated to lower deuteron energies. Other published results are in agreement with the formula if  $m = -1$ .

A. J. E. W.

Elastic and inelastic scattering of fast neutrons. D. C. GRAHAME and G. T. SEABORG (Physical Rev., 1938, [ii], 53, 795—801).—Cross-sections for the combined processes of absorption and inelastic scattering of fast neutrons ( $>4.5$  and  $>7$  M.e.v.), measured for a no. of elements by the use of absorbing cylinders and Al or Fe detectors, show a smooth increase with increasing at. no. For neutrons of energies  $>7$  M.e.v. the ratio of these cross-sections to the cross-section for absorption + total scattering is approx. const. at about 0.4. The existence of a scattering of fast neutrons in which little or no energy is lost is demonstrated experimentally and approx. cross-sections are obtained. Cross-sections for an "effective absorption" of medium fast neutrons are smaller than those for the faster neutrons and show a max. for at. no. about 50 and a marked decrease for the heaviest elements (cf. A., 1937, I, 593). N. M. B.

Absorption of group A neutrons in silver. H. PAXTON (Nature, 1938, 141, 971—972).—An absorption curve for group A neutrons, from Rn +

Be in paraffin, in Ag with thin detectors (0.01 to 0.006 g. per cm.<sup>2</sup>) is reproduced. The points for zero and 0.0058 g. per cm.<sup>2</sup> absorption give a min. val. of  $59 \pm 19$  cm.<sup>2</sup> per g. for the absorption coeff.

L. S. T.

Yield and energy of neutrons from the nuclear reaction  ${}^2_1\text{D} + {}^2_1\text{D} = {}^3_2\text{He} + {}^1_0\text{n}$ . E. BALDINGER, P. HUBER, and H. STAUB (Helv. Phys. Acta, 1938, 11, 245—268).—A canal-ray tube for the production of deuterons, with associated ionisation chamber, amplifier, and recording oscillograph, is fully described. Using a  $\text{D}_3\text{PO}_4$  target the apparatus is equiv. as a neutron source to  $\sim 0.5$  g. Ra + Be, the total neutron yield being  $1.15 \times 10^7$  per sec. using 130 kv. deuterons. The yield referred to a pure D target and 100 kv. deuterons is one neutron per  $8 \times 10^6$  deuterons. The energy of the neutrons at  $51^\circ$  to the 130 kv. deuteron beam is 2.6 M.e.v., the energy yield of the D + D reaction being 3.1 M.e.v. The variation of the yield with the accelerator voltage and deuteron current has been investigated. A. J. E. W.

Loss of neutrons by neutron bombardment and the radioactive isotopes of scandium. J. M. CORK and R. L. THORNTON (Physical Rev., 1938, [ii], 53, 866—868).—The bombardment of Li by 6.3 M.e.v. deuterons yields neutrons of energy up to 20 M.e.v., which in turn are able to produce disintegrations by the ejection of two neutrons from bombarded nuclei. In the case of Sc, evidence is obtained by varying the energy of the incident neutrons and observing the ratio of the 4 hr. and 53 hr. radioactivities produced that these are due to isomerides of  ${}^{44}\text{Sc}$  rather than to the ejection of three neutrons from the excited nucleus. The excitation function for the ejection of two neutrons is studied for various elements by observing the activity produced at various energies of the incident neutrons, and anomalous behaviour for certain elements is found. N. M. B.

Absorption of slow neutrons in dysprosium and cadmium. J. J. GUREVITSCH and M. G. MESCHTSCHERJAKOV (Physikal. Z. Sovietunion, 1938, 13, 151—169).—The absorption of Dy is almost entirely confined to the C neutrons, but a weak absorption also occurs at approx. 0.6 e.v. Absorption is mainly due to  ${}^{164}\text{Dy}$  and leads to the formation of radio-Dy. The absorption coeffs. in Cd of C neutrons and of neutrons of 0.6 e.v. energy are 15.8 cm.<sup>2</sup> per g. and 0.54 cm.<sup>2</sup> per g., respectively. The position and width of the Cd resonance band are calc. to be 0.17 e.v. and 0.18 e.v., respectively. O. D. S.

Slow neutrons and nuclear energy levels. E. FERMI (Nuovo Cim., 1938, 15, 41—42).—A summary of work on the determination of nuclear energy levels by means of absorption measurements of slow neutrons. O. J. W.

Neutrons by  $\alpha$ -particle bombardment of light elements. C. S. COPELAND and S. C. LIND (J. Physical Chem., 1938, 42, 567—574).—The neutron emission under bombardment by  $\alpha$ -particles from Rn has been studied for all elements from Li to Ca by measurement of the radioactivity induced in I. Definite neutron emission was observed from Li, Be, B, N, F, Na, Mg, Al, P, and Cl compounds, but the



emission from C, SiO<sub>2</sub>, S, K<sub>2</sub>CO<sub>3</sub>, CaCO<sub>3</sub>, and Zn is <0.5% of that of Be. J. W. S.

**Collisions of deuterons with heavy nuclei.** I. E. LIFSCHITZ (Physikal. Z. Sovietunion, 1938, 13, 224—243).—Mathematical. Collisions leading to the disintegration of the deuteron and capture by the nucleus of a neutron are discussed. The reaction cross-section as a function of deuteron energy, and the energy distribution of the outgoing particles, are calc. O. D. S.

**Fine structure of the yield-curve of the transmutation of aluminium.** A. SZALAY (Nature, 1938, 141, 972—973).—A graph showing the integral yield of positrons from <sup>30</sup>P, obtained by bombardment of Al with  $\alpha$ -rays from a Po source, as a function of the average range of exciting  $\alpha$ -particles is reproduced. At each  $\alpha$ -particle range where levels are observed for proton emission, resonance levels for the neutron emission exist. Unlike the proton yields, the neutron yield for each of these four levels is different. The ratio proton yield : neutron yield decreases with an increase in energy of the exciting  $\alpha$ -particle. L. S. T.

**Artificial radioactivity. III.** K. DIEBNER and E. GRASSMANN (Physikal. Z., 1938, 39, 469—501; cf. A., 1936, 773; 1937, I, 389).—A comprehensive review of results of the investigation of artificial radioactivity up to March, 1938. A. J. M.

**Measurements on slow neutrons.** E. SEGRÈ (Ric. Sci. Progr. tech., 1936, [ii], 7, 389—390; Chem. Zentr., 1936, ii, 1836—1837).—The 44-sec. and the 4.2-min. activities of Rh are affected in the same way by the insertion of Cd. With Cu, the 5-min. activity is reduced in the ratio 5 : 1 and the 10-hr. activity falls practically to zero. For Ag and Rh, the reflexion coeff. for group C neutrons within a H<sub>3</sub>BO<sub>3</sub> solution decreases with an increase in [H<sub>3</sub>BO<sub>3</sub>]. L. S. T.

**Disintegration of boron by slow neutrons.** J. C. BOWER, E. BRETSCHER, and C. W. GILBERT (Proc. Camb. Phil. Soc., 1938, 34, 290—295).—The disintegration of B by slow neutrons according to  $^{10}\text{B} + \frac{1}{2}n = \frac{7}{3}\text{Li} + \frac{4}{2}\text{He}$  produces Li and He particles with ranges  $4.3 \pm 0.2$  mm. and  $7.0 \pm 0.3$  mm. in standard air. The Li particle is usually found in an excited state with an excitation energy of 0.5 or 0.8 Me.v. F. J. L.

**Further experiments on the slow neutrons transmitted by cadmium: influence of the temperature of the slowing-down medium.** C. H. WESTCOTT and L. SOSNOWSKI (Proc. Camb. Phil. Soc., 1938, 34, 272—281).—The neutrons of group B have energies low enough to be affected by temp. It is suggested that Cd transmits neutrons of energies down to 0.2 e.v., and that group B is inhomogeneous. F. J. L.

**Excitation functions of the ( $\alpha$ , n) transitions of nitrogen, aluminium, and argon.** E. FÜNFER (Ann. Physik, 1938, [v], 32, 313—335).—The  $^{14}\text{N}(\alpha, n)^{17}\text{F}$ ,  $^{27}\text{Al}(\alpha, n)^{30}\text{P}$ , and the  $^{40}\text{Ar}(\alpha, n)^{43}\text{Ca}$  transitions were studied by passage of  $\alpha$ -particles successively through the gas, paraffin, and B into symmetrically disposed counter tubes. The paraffin serves to slow down the neutrons to thermal velocities

and the B reconverts them into  $\alpha$ -particles. The excitation curves obtained are discussed in relation to the resonance levels of the mol. examined. L. G. G.

**Long-lived radio-cobalt isotopes.** J. J. LIVINGOOD and G. T. SEABORG (Physical Rev., 1938, [ii], 53, 847—848; cf. A., 1937, I, 490).—Activity and absorption curves of chemically separated radioactive Co obtained from neutron and deuteron bombardment of Co<sub>2</sub>O<sub>3</sub> are given and discussed. The initial rate of decay indicates a 2-year period, but subsequently becomes of the order 10 years. The activity attributed by Perrier (cf. A., 1938, I, 111) to Co formed from Cu on the cyclotron deflector plate is probably due to the two Co periods produced from the deuteron bombardment of Fe. N. M. B.

**Artificial transition processes by irradiation of thorium with neutrons.** Appearance of isomeric series through expulsion of  $\alpha$ -rays. L. MEITNER, F. STRASSMANN, and O. HAHN (Z. Physik, 1938, 109, 538—552).—Four transition processes are shown to occur by bombardment of Th with slow and fast neutrons, one of which is initiated by direct neutron capture and the other three by neutron capture and  $\alpha$ -particle expulsion. Half-life periods of the components of the series are given. L. G. G.

**Nature of the radioelement of period 3.5 hours formed in uranium irradiated by neutrons.** (MME.) I. CURIE and P. SAVITCH (Compt. rend., 1938, 206, 1643—1644; cf. A., 1938, I, 291).—The radiation of the element (R<sub>3.5h</sub>) consists of electrons with a small proportion of positrons, possibly due to internal materialisation of  $\gamma$ -rays. The chemical properties resemble those of the Ce earths and Ac; R<sub>3.5h</sub> can, however, be separated from Ac by fractional pptn. of the oxalates in HNO<sub>3</sub>. It is concluded that R<sub>3.5h</sub> is a new trans-uranian element. A. J. E. W.

**$\gamma$ -Radiation from proton bombardment of carbon.** M. E. ROSE (Physical Rev., 1938, [ii], 53, 845).—Evidence is given that the 560 k.e.v. resonance radiation observed in the capture of protons by C and assigned to the capture of protons by <sup>13</sup>C with formation of <sup>14</sup>N is not monochromatic. The absorption curve and the reaction when C is bombarded by deuterons point to the existence of three  $\gamma$ -rays, one of 8.2 Me.v., and two of about 4 Me.v., the absorption curve being a superposition of the three individual curves weighted according to the intensities of the  $\gamma$ -rays. N. M. B.

**Neutron-electron interaction proposed by Kikuchi.** G. T. SEABORG and D. C. GRAHAME (Nature, 1938, 141, 1053).—The emission of  $\gamma$ -rays in the D-D reaction (A., 1938, I, 169) offers a simpler and more satisfactory explanation of the phenomena observed by Kikuchi *et al.* (A., 1937, I, 4). L. S. T.

**Pressure-dependence of ionisation due to ultra-radiation and  $\gamma$ -radiation.** J. CLAY (Z. Physik, 1938, 109, 477—484).—The column-ionisation formula of Jaffé, as modified by Zanstra, is verified by measurements of the ionisation produced by cosmic and  $\gamma$ -rays in air, CO<sub>2</sub>, and A at pressures up to 150 atm. The relationship between degree of satur-



ation and field strength is discussed. It is found that  $\gamma$ -ray ionisation is approx.  $\propto$  (at. no.)<sup>2</sup> and cosmic ray ionisation approx.  $\propto$  density. L. G. G.

**Specific ionisation and mass of cosmic-ray particles.** D. R. CORSON and R. B. BRODE (Physical Rev., 1938, [ii], 53, 773—777).—The sp. ionisation of 120 cosmic-ray tracks for  $H_p 10^3-2 \times 10^5$ , measured by counting droplets in photographs of delayed expansion cloud-chamber tracks, is in good agreement with theory. Results are applied to the calculation of the mass of heavily ionising cosmic-ray particles. The masses of all heavy particles are in approx. agreement with a unique mass of  $(200 \pm 50)m_0$ . N. M. B.

**Influence of the solar magnetic field on cosmic rays.** P. S. EPSTEIN (Physical Rev., 1938, [ii], 53, 862—866).—The effect of the solar field on cosmic-ray intensities at different localities on the earth, and the diurnal and annual variations of the solar effect, are calc. and discussed. N. M. B.

**Nature and origin of the incoming cosmic rays.** I. S. BOWEN, R. A. MILLIKAN, and H. V. NEHER (Physical Rev., 1938, [ii], 53, 855—861; cf. A., 1938, I, 171).—Quant. data on the smallness of the fraction of the total incoming energy that can be assigned to photons show that the cosmic rays cannot have come through an appreciable amount of matter in comparison with an atm. before entering the solar system. The energies of the incoming rays correspond roughly with the annihilation energies of the atoms of the most abundant elements. N. M. B.

**Penetrating component of the cosmic radiation.** J. BARNÓTHY and M. FORRÓ (Physical Rev., 1938, [ii], 53, 848).—Curves of the intensity variation of cosmic ray showers from 4000 m. above sea level to 1000 m.  $H_2O$  equiv. depth show bends at about 10—20 m. and at 250 m.  $H_2O$  equiv., indicating that from these depths onwards the showers are produced mainly by heavy electrons and by neutrinos, respectively (cf. Wilson, A., 1938, I, 225). N. M. B.

**Nature of the penetrating cosmic rays.** V. C. WILSON (Physical Rev., 1938, [ii], 53, 908—909; cf. A., 1938, I, 225).—Investigations described support the view that the type of penetrating cosmic ray with a max. range of 250 m.  $H_2O$  equiv. consists of heavy electrons, and that the one with a much greater range consists of neutrinos. N. M. B.

**Actual experimental knowledge about cosmic radiation.** B. ROSSI (Nuovo Cim., 1938, 15, 43—65).—A summary. O. J. W.

**Secondary effects of the hard and soft components of cosmic rays.** B. TRUMPY (Nature, 1938, 141, 909—910).—A statistical investigation of the no. of secondary cosmic rays produced in an Fe-screened and an unscreened automatic cloud chamber, divided into sections by four parallel Pb plates, 3 cm. thick, shows that the soft components of the cosmic rays amount to approx. 27% of the total radiation at the earth's surface, and that the hard components cannot be electrons. L. S. T.

**Mathematical formalism of the theory of showers.** D. IVANENKO and A. SOKOLOV (Physical Rev., 1938, [ii], 53, 910). N. M. B.

**Hoffmann showers and the penetrating component of ultra-radiation.** H. EULER (Naturwiss., 1938, 26, 382—383).—Theoretical. The constns. of the electron-spectra concerned in cascade showers are calc. A. J. M.

**High-altitude cosmic radiation measurements near the magnetic axis-pole.** H. CARMICHAEL and E. G. DYMOND (Nature, 1938, 141, 910—911).—The radiation intensity at the pole is approx. equal to that at latitude  $50^\circ$ . Cosmic rays of energy  $<$  approx.  $3 \times 10^9$  e.v. either do not exist in space or are prevented from reaching the earth by an agency other than the terrestrial magnetic field. L. S. T.

**Formation of free sodium atoms in the upper atmosphere.** R. BERNARD (Compt. rend., 1938, 206, 1669—1672; cf. A., 1938, I, 285).—The following mechanism for the formation of Na atoms is discussed:  $N_2 (A^3\Sigma) + H_2O \rightarrow N_2 (X^1\Sigma) + OH + H$ ;  $H + NaCl \rightarrow HCl + Na$ . The NaCl is assumed to be of oceanic origin. This mechanism accounts for the occurrence of OH bands in the sky spectrum. A. J. E. W.

**Elements 43 and 61.** H. JENSEN (Naturwiss., 1938, 26, 381).—The possibility of the existence of elements of at. no. 43 and 61 is discussed from the viewpoint of Mattauch's rule that of two isobares which differ by 1 in nuclear charge, one must be unstable. Since  $^{60}Nd$  and  $^{62}Sm$  are both abundant and stable, the rule predicts the non-existence of a stable isotope of at. no. 61. This is also true for the isotope of at. no. 43. The possibility of the existence of  $\beta$ -active isotopes with these mass nos. and with comparatively long life cannot, however, be excluded, although it is very improbable. It might also be possible that one of the isotopes adjacent to element 43 or 61 is  $\beta$ -active with a very long life. Anomalies in the curve of energy surface of the nucleus as a function of at. no. also support the view that isotopes of 43 and 61 cannot exist. A. J. M.

**Nuclear structure of radioactive substances.** U. C. BARDHAN (Phil. Mag., 1938, [vii], 25, 1033—1041).—Mathematical. T. H. G.

**Tracks of stellar evolution.** G. GAMOW (Physical Rev., 1938, [ii], 53, 907—908; cf. A., 1938, I, 291).—The relation between the features of the star distribution along the main sequence and the proton-proton reaction is examined. N. M. B.

**Reversibility of the equations of classical dynamics.** E. A. MILNE and G. J. WHITROW (Nature, 1938, 141, 905—906).—Theoretical. L. S. T.

**Theory of exchange forces.** D. IVANENKO (Physikal. Z. Sovietunion, 1938, 13, 141—150).—Mathematical. Some special cases of exchange action transformations are discussed with reference to the theory of nuclear  $\beta$ -ray decomp. O. D. S.

**Binding energy of the atomic nucleus and  $\alpha$ -decay.** V. TSCHERDINZEY (Physikal. Z. Sovietunion, 1938, 13, 170—180).—Theoretical. Using the liquid drop model of the at. nucleus, a relation is obtained between the at. wt. and the binding energy in the nucleus, agreeing with experiment. A derived relation between  $\alpha$ -decay energy and at. wt. has a max.



in the region of natural emitters and leads to a relation between the life-time of  $\alpha$ -emitters and their at. wts. agreeing with experiment. O. D. S.

**Atomic constants.** E. DE MAYOLA (Bol. Soc. Quím. Peru, 1938, 4, 25—50).—A survey of the literature. F. R. G.

**Rotation of the atomic nucleus.** E. TELLER and J. A. WHEELER (Physical Rev., 1938, [ii], 53, 778—789).—The spacing of the levels in the fine structure of  $\alpha$ - and  $\beta$ -ray processes and the existence of metastable nuclear states contradict the existence of low-lying levels corresponding with the rotation of the nucleus as a whole. The exchange of the nuclear constituents effected through rotation, and the absence of rigid binding in the nucleus, will in some cases forbid and in other cases perturb the lowest levels and cause the first state of excitation to lie considerably higher. Simple models illustrating these effects are discussed. The estimated position of the lowest excited level for heavy nuclei varies inversely with the mass. N. M. B.

**Energy content of the heavy nuclei.** A. J. DEMPSTER (Physical Rev., 1938, [ii], 53, 869—874).—A packing fraction curve is drawn from known at. masses (cf. A., 1938, I, 111) and from new vals. for Sn, La, and Nd, and in agreement with differences in packing fractions for 25 pairs previously reported. The curve has the general shape of Aston's curve, but has a higher min. and is higher for the heavy elements. For those below Pb the curve is much less steep than above, giving an energy content to these elements such that  $\alpha$ -ray emission is impossible. The mass differences of Pb, Th, and U in relation to  $\alpha$ - and  $\beta$ -ray emission are discussed. The effect of the packing fractions on the computed at. wt. of Lu, Nd, Th, and U is examined, and the masses of isotopes of Au, Sn, Nd, and La are compared. N. M. B.

**Excited states of the  $^3\text{H}$  and  $^4\text{He}$  nuclei.** S. S. SHARE (Physical Rev., 1938, [ii], 53, 875—879).—Mathematical. A discussion of investigations made with trial wave functions. N. M. B.

**Magnetic moment of  $^7\text{Li}$  in the  $\alpha$ -particle model.** H. A. BETHE (Physical Rev., 1938, [ii], 53, 842).—The discrepancy between the difference vals. of the  $^7\text{Li}$  and  $^4\text{He}$  moments, as found by Rabi's high-precision method (cf. A., 1938, I, 293) and from theories based on the one-particle Hartree model, is examined and an explanation is proposed. N. M. B.

**Nuclear magnetic moment of  $^7\text{Li}$  by perturbation theory.** D. R. INGLIS (Physical Rev., 1938, [ii], 53, 880—888).—Mathematical. First-order calculations show that the orbital part of the magnetic moment is 0.26—0.30  $\mu_N$ ; the second-order modification is very small (0.01  $\mu_N$  from the doubly excited states). N. M. B.

**Saturation of nuclear forces.** C. CRITCHFIELD and E. TELLER (Physical Rev., 1938, [iii], 53, 812—818).—Mathematical. The forces between heavy particles (neutrons and protons) are investigated on the assumption that they emit electron-positron pairs and that the interaction of the heavy particles with the field of light particles is large compared with

the kinetic energy of the light particles. It is shown that potentials result which are of the same order of magnitude as the kinetic energy of the light particles. When many heavy particles interact the total potential energy  $\propto$  the no. of particles. N. M. B.

**Self-consistent field for molecular hydrogen.** C. A. COULSON (Proc. Camb. Phil. Soc., 1938, 34, 204—212).—An analytical expansion of the wave function of mol.  $\text{H}_2$  is obtained, using the method of the self-consistent field. F. J. L.

**Potential barrier in nuclear mechanics and nuclear dimensions of heavy radioactive elements.** T. KAHAN (Compt. rend., 1938, 206, 1289—1291).—Theoretical. A. J. E. W.

**Wave function of the He ground state.** J. SOLOK (Physikal. Z. Sovietunion, 1937, 12, 120—122).—Theoretical. J. A. D.

**Existence of a neutrino.** H. R. CRANE and J. HALPERN (Physical Rev., 1938, [ii], 53, 789—794).—In a new method for determining the energy of recoil of the nucleus in the individual  $\beta$ -disintegration process the cloud chamber contains  $^{38}\text{Cl}$ , and the clearing field is removed long enough before the expansion to allow the ions to spread out so that the resulting droplets can be seen individually. A cluster of droplets, believed to be produced by the recoil nucleus, appears at the beginning of the track, and the kinetic energy of the nucleus, estimated from the no. of droplets, is compared with that calc. from the observed curvature of the  $\beta$ -ray track. The laws of momentum and of energy indicate that a third particle participates in the disintegration. N. M. B.

**Connexion between electromagnetic and neutrino fields.** (A) A. SOKOLOV. (B) M. H. L. PRYCE (Nature, 1938, 141, 976).—Theoretical. L. S. T.

**Representation of the plane monochromatic wave solutions of the equation of Dirac.** G. PETIAU (J. Phys. Radium, 1938, [vii], 9, 171—177).—Mathematical. W. R. A.

**Temperature variation of electron spin paramagnetism: numerical results.** E. C. SPONER (Proc. Leeds Phil. Soc., 1938, 3, 403—415; cf. A., 1936, 266, 785). F. J. L.

**Triplet-triplet perturbations in band spectra.** I. KOVÁCS (Z. Physik, 1938, 109, 387—392).—It is shown that a suitable transformation of the determinantal product, involving a simplification of the 9-termed secular determinant of the  $^3\Sigma \leftrightarrow ^3\pi$  perturbation, leads to an explicit calculation of the perturbed term. L. G. G.

**Singlet-triplet perturbations in band spectra.** A. BUDÓ and I. KOVÁCS (Z. Physik, 1938, 109, 393—402; cf. preceding abstract).—Modifications of the Hamiltonian operator in the formulation of singlet-triplet perturbations are derived. A  $^3\Sigma$  perturbation of the  $A^{11}\text{CO}$  term is given as an example. L. G. G.

**Absorption spectrum of fluorene in various states of aggregation.** B. TWAROWSKA (Z. Physik, 1938, 109, 403—412).—Absorption spectra of fluorene as vapour, solid, and solute (in *o*-xylene) were photo-



graphed in the visual range at room temp. and also, in the case of the solid and solute, at  $-180^\circ$ . At  $-180^\circ$ , resolution of the diffuse band obtained at room temp. into a series of narrow bands occurs, this being most noticeable in the crystal. Peculiarities in the fluorescence of fluorene in different states are discussed. L. G. G.

**New anomalous effect in the short-wave end of the solar spectrum.** I. S. RODIONOV, E. PAVLOVA, and N. STOOPIKOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, 19, 55—57).—Curves for the intensity of the short  $\lambda$  of the solar spectrum as a function of the length of a ray path through a layer of  $O_3$  show anomalies for oblique morning and evening sunlight. It is suggested that the effect is due to anomalous refraction of short  $\lambda$  in the  $O_3$  layer. N. M. B.

**Umkehr effect.** II. S. RODIONOV and E. PAVLOVA (Compt. rend. Acad. Sci. U.R.S.S., 1938, 19, 59—60).—At great zenith distances of the sun, the scattered zenith light intensity ratio of two close  $\lambda$  in the region 3300—3100 Å. passes through a min. (Umkehr effect; cf. Götz *et al.*, A., 1934, 1087). New measurements are plotted and discussed; a comparison is made with the anomalous effect previously described (cf. preceding abstract). N. M. B.

**Absorption coefficients of ozone in the region of the Chappuis bands.** (MME.) A. VASSY (Compt. rend., 1938, 206, 1638—1639; cf. A., 1938, I, 58).—Vals. of the absorption coeff. at  $18^\circ$  for  $\lambda$  between 4380 and 7585 Å. are tabulated. A. J. E. W.

**Spectrum of the nuclei of comets and the bands of the CH molecule.** J. DUFAY (Compt. rend., 1938, 206, 1550—1553).—The group of lines at  $\sim 4300$  Å., observed in the spectra of five comets, corresponds with the  $0 \rightarrow 0$  and  $1 \rightarrow 1$  bands of the  $A \rightarrow X$  system of CH, except a line at 4319 Å. due to  $N_2$  (A., 1937, I, 207). The group at  $\sim 4050$  Å. may also be due to a CH transition involving a hitherto unknown level. A. J. E. W.

**Distribution of the rotation state in an elementary process of molecule formation (not Boltzmann distribution) and alteration of the relative probability of transition.** H. SCHÜLER and H. GOLLENOW (Z. Physik, 1938, 109, 432; cf. A., 1938, I, 341).—An addendum. H. C. G.

**Absorption spectrum of caesium hydride.** G. M. ALMY and M. RASSWEILER (Physical Rev., 1938, [ii], 53, 890—894).—A  $^2\Sigma \rightarrow ^2\Sigma$  mol. spectrum of CsH photographed in absorption in the range 4550—6250 Å. consists of 31 two-branch bands. The calc. rotational and vibrational consts. for two electronic states show the anomaly characteristic of the alkali hydrides. The heats of dissociation are 1.10 and 1.96 v. for the excited and ground states. Potential energy curves are given, and show that Mulliken's explanation of the anomaly (cf. A., 1937, I, 66) covers the case of CsH. N. M. B.

**Band spectra of SrCl and SrH.** K. R. MORE and S. D. CORNELL (Physical Rev., 1938, [ii], 53, 806—811).—The spectra of SrCl and SrH are observed in absorption (cf. A., 1932, 439; 1935, 1443; 1936, 267, 1317). Parker's SrCl analysis is confirmed

(cf. A., 1935, 562). Measurement of the relative intensities of corresponding bands of the electronic doublet  $^2\Pi \rightarrow ^2\Sigma$  indicates that  $^2\Sigma$  is the ground state. Consts. are evaluated from rotational and vibrational analyses, and perturbations are discussed. N. M. B.

**Mechanism of formation of mercury hydride and mercury deuteride. Optical excitation of cadmium deuteride.** L. O. OLSEN (J. Chem. Physics, 1938, 6, 307—310).—A mixture of Hg vapour,  $H_2$ , and  $N_2$  was illuminated by a Hg and H (or He) discharge. The spectrum of the excited radiation revealed the presence of HgH, but no resonance excitation of HgH was observed. This indicates that the HgH mols. are formed in an excited state and dissociate after emission. The formation process,  $Hg\ 6^3P_1 + H \rightarrow HgH\ ^2\Pi_{1/2, 3/2} + \Delta$  ( $\Delta$  is an energy parameter), is supported by experimental evidence. Similar results were obtained for HgD. Resonance excitation of CdH (or CdD) was confirmed when a mixture of Cd and  $H_2$  (or  $D_2$ ) was illuminated with a Cd and H (or D) discharge. W. R. A.

**Ultra-violet radiation of crystals under the action of  $\gamma$ -rays.** E. K. ZAVADOVSKAJA (Physikal. Z. Sovietunion, 1938, 13, 244—246).—NaCl,  $SiO_2$ , and  $CaCO_3$  crystals emit in the ultra-violet region under the action of  $\gamma$ -rays from a Ra source. O. D. S.

**Effect of irradiation on the transmission of lithium fluoride.** E. G. SCHNEIDER (J. Opt. Soc. Amer., 1937, 27, 72—74).—The transmission of LiF in the visible and ultra-violet is reduced by exposure to intense ultra-violet radiation, electron bombardment, or contact with a low-pressure electrical discharge. Exposure for 75 hr. to the light of a H discharge tube caused only about 5% max. transmission decrease, but in the other two cases strong absorption bands with max. at 5200, 3100, and 2500 Å. and a gradually increasing absorption below 1800 Å. appear after a few min. exposure. Practical applications are discussed. N. M. B.

**Band spectra of alkaline-earth iodides.** P. MESNAGE (Compt. rend., 1938, 206, 1634—1635).—An analysis has been made of emission band systems of  $CaI_2$  (4180—4380 Å.),  $SrI_2$  (4250—4480 Å.), and  $BaI_2$  (5360—5610 Å.), due in each case to the diat. mols. MI.  $CaI_2$  gives a single band system,  $SrI_2$  two distinct systems, and  $BaI_2$  certain sequences of a doublet system. A. J. E. W.

**Spectra of absorption by reflexion of solid substances in the visible and ultra-violet.** M. BILLY and A. BERTON (Compt. rend., 1938, 206, 1631—1634).—The spectrum of light reflected from a rough solid surface consists of a continuum due to pure reflexion, on which absorption bands due to internal reflexion and absorption in the surface particles are superposed. These bands are characteristic of the chemical composition, cryst. structure, or degree of polymerisation of the substance examined. A no. of typical spectra, including those of aq.  $H_2C_2O_4$ , are reproduced and discussed. A. J. E. W.

**Absorption bands and electron transitions in coloured fluorites.** K. PRZIBRAM (Nature, 1938,



141, 970; cf. A., 1937, I, 220).—The different colours of fluorites can be explained by the varying intensities of the different absorption max.  $\text{Eu}^{++}$  alone gives a light yellow colour (Derbyshire);  $\text{Sm}^{++}$ , a deeper yellowish-brown; the bivalent rare earths together with the Ca max., the green colours (Weardale); and predominance of the Ca max., the blue and violet colours. Various colour changes brought about by light or heat are attributed to the transfer of electrons between the bivalent rare-earth ions and the  $\text{Ca}^{++}$  ions. L. S. T.

**Absorption spectra and chemical processes in discharges.** N. PRILESHAEVA and G. NETER (J. Phys. Chem. Russ., 1938, 11, 254—261).—An attempt is made to identify the reaction products by observing the absorption spectra of gas mixtures before, during, and after the discharge. Thus,  $\text{NH}_2\text{Ph}$  is shown to be formed from  $\text{C}_6\text{H}_6$  and  $\text{NH}_3$ ,  $\text{C}_6\text{H}_6$  from  $\text{PhNO}_2$  and  $\text{H}_2$ ,  $\text{PhOH}$  from  $\text{C}_6\text{H}_6$  and  $\text{H}_2\text{O}$ ,  $\text{PhCHO}$  from  $\text{C}_6\text{H}_6$  and  $\text{CO}$ , and  $\text{C}_6\text{H}_6$  from  $\text{PhCHO}$ . Fluorescence spectra reveal the reaction  $\text{C}_6\text{H}_6 + \text{CH}_4 \rightleftharpoons \text{PhMe} + \text{H}_2$ . No formation of  $\text{NH}_2\text{Ph}$  from  $\text{PhOH}$  and  $\text{NH}_3$ , or of  $\text{C}_6\text{H}_6$  from  $\text{PhOH}$  and  $\text{H}_2$ , can be detected. J. J. B.

**Absorption spectra of co-ordination compounds.** I. R. TSUCHIDA (Bull. Chem. Soc. Japan, 1938, 13, 388—400).—The origins of absorption bands of co-ordination compounds are discussed. The first band is more or less additive, and is attributed to electron transitions in the unsaturated transition shell of the central ion, and is absent if the central ion is not a transition element. The second band is attributed to the co-ordination electrons, and is therefore the most general characteristic of these compounds. The third band is due to one or more pairs of negative radicals co-ordinated in *trans* positions, and is independent of the kind and valency of the central ion, the sort of radical provided it is negative, the charge of the complex radical, or the configuration so long as the *trans* pairing condition is fulfilled. C. R. H.

**Absorption spectra. II. Spectra of toluidine, benzidine, and their hydrochlorides.** (MLLE.) C. DE BORST, P. M. HEERTJES, and H. I. WATERMAN (Bull. Soc. chim., 1938, [v], 5, 888—895; cf. A., 1936, 661, 1443).—The absorption spectra of *p*-toluidine, benzidine, and their hydrochlorides have been measured over the range  $\lambda$  2200—3500 in  $\text{H}_2\text{O}$ , and those of  $\text{PhMe}$  and of  $\text{Ph}_2$  in  $\text{C}_6\text{H}_{14}$ . The spectra of the hydrochlorides differ considerably from those of the amines, being displaced towards shorter  $\lambda$  and approximating closely to those of the corresponding hydrocarbons. From the results it is deduced that the dissociation const. of *p*- $\text{C}_6\text{H}_4\text{Me}\cdot\text{NH}_3\text{Cl}$  is  $2.03 \times 10^{-5}$  at 18°. J. W. S.

**Absorption spectra of para-substituted derivatives of azobenzene.** The Dilthey-Wizinger chromophor theory. A. PONGRATZ, G. MARKGRAF, and E. MAYER-PITSCH (Ber., 1938, 71, [B], 1287—1296).—The absorption spectra of azobenzene (I) and the following derivatives of it have been measured: *p*-hydroxy-, m.p. 155—156° (corr.); *p*-amino-, m.p. 124.5—125.5° (corr.); *p*-acetamido-, m.p. 144—145° (corr.); *p*-dimethylamino-, m.p. 118—118.5°

(corr.); *p*-nitro-, m.p. 134.5—135° (corr.); *p*-nitro-*p*'-hydroxy-, m.p. 219.0—219.5° (corr.); *p*-amino-*p*'-hydroxy-, m.p. 188—189° (corr.); *p*-acetamido-*p*'-hydroxy-, m.p. 202.5—203° (corr.); *p*-nitro-*p*'-dimethylamino-, m.p. 234.5—235.0° (corr.); *p*-amino-*p*'-dimethylamino-, m.p. 191.5—192° (corr.); *p*-acetamido-*p*'-dimethylamino-, m.p. 226—227° (corr.); *p*-azobenzenetrimethylammonium iodide (II), m.p. 185.5—186° (corr.), and *p*-acetamidazobenzene-*p*'-trimethylammonium iodide (III), m.p. 197° (corr.). The displacement of the band max. towards lower frequencies increases regularly in the sequence H,  $\text{NMe}_2$ , I,  $\text{NO}_2$ , OH, and  $\text{NHAc}$ ,  $\text{NH}_2$ ,  $\text{NMe}_2$  as a consequence of the increasingly marked electric contrast at the N atoms of the  $\text{N}_2$  group. With the exception of  $\text{NO}_2$  the groups are to be regarded as relatively positive. For the same reason invariable displacements of the main bands are observed when one substituent remains unaltered and the second, in the other  $\text{C}_6\text{H}_6$  nucleus, is altered: when, for example, the groups H,  $\text{NHAc}$ ,  $\text{NH}_2$ ,  $\text{NO}_2$  are successively brought into contraposition to  $\text{NMe}_2$ . The absorption curves of (II) and (III) harmonise with Wizinger's conception. (I) reacts with  $\text{MeI}$  giving crystals of unelucidated nature. H. W.

**Halochromy phenomena in perylene, its quinones and substitution products.** M. PESTEMER, A. J. K. SCHMIDT, L. SCHMIDT-WILIGUT, and F. MANCHEN (Monatsh., 1938, 71, 432—439).—Absorption curves in the visible and ultra-violet regions are given for perylene, 3:4:9:10-tetra-benzoyloxy-, 1:12-dihydroxy-3:9-dibenzoyl-, 3:9-dibenzoyl-, and 3:9-diphenyldivinyl-perylene, perylene-3:9-, perylene-1:12-, 3:9-dibenzoyl-perylene-1:12-, 2:11-dihydroxyperylene-3:10-, and 2:11-dibenzoyloxyperylene-3:10-quinone in inert solvents (heptane, decalin,  $\text{C}_6\text{H}_6$ ) and in  $\text{H}_2\text{SO}_4$ . In the inert solvents characteristic differences between the benzenoid derivatives and the quinones are noted. In  $\text{H}_2\text{SO}_4$  the curves for perylene and its benzenoid derivatives resemble those for the 3:10-quinones, indicating the formation of halochromic additive products by attack of  $\text{H}_2\text{SO}_4$  at the 3:10-positions of perylene. E. S. H.

**Absorption spectrum of heavy water in the near infra-red.** G. CHAMPETIER, R. FREYMAN, and Y. TA (Bull. Soc. chim., 1938, [v], 5, 929—931).—The existence of intense bands at 2.0 and 1.33  $\mu$ . and weak bands at 1.70 and 1.19  $\mu$ . is confirmed. A new band has been observed at 1.016  $\mu$ . Other bands previously reported are attributed to traces of  $\text{H}_2\text{O}$ . The absorption of  $\text{D}_2\text{O}$  is much weaker than that of  $\text{H}_2\text{O}$ . J. W. S.

**Change in absorption of water at 4.7  $\mu$ . due to solutions.** E. K. PLYLER and E. S. BARR (J. Chem. Physics, 1938, 6, 316—318).—Aq. solutions of K and  $\text{NH}_4$  halides have been examined in the region 3.0—5.4  $\mu$ . and  $\text{NaBr}$  in the region 4.5—6.5  $\mu$ . The effects of changes in concn. and in positive ion are discussed. Fluorides change the position of the  $\text{H}_2\text{O}$  band from 4.72 to shorter  $\lambda$ , whilst chlorides, bromides, and iodides alter it to longer  $\lambda$ . This effect may be due to changes in hindered rotation produced



by binding forces between the ions and the  $H_2O$  mols. W. R. A.

**Structure of the methane molecule.** H. A. JAHN and W. H. J. CHILDS (*Nature*, 1938, **141**, 916).—The complex rotational fine structure of the  $1306\text{ cm}^{-1}$  fundamental vibrational band of  $CH_4$  is due to a Coriolis coupling between the rotational levels of this threefold degenerate mode of vibration  $\nu_4$  and the rotational levels of the infra-red inactive twofold degenerate vibration  $\nu_2$  at  $1536\text{ cm}^{-1}$ . A theoretical spectrum that agrees well with that observed has been derived. Similar perturbations may be expected in the spectra of all polyat. mols. possessing a threefold or higher axis of symmetry. L. S. T.

**Infra-red absorption bands in the spectrum of deuterioformaldehyde.** E. S. EBERS and H. H. NIELSEN (*J. Chem. Physics*, 1938, **6**, 311—315; cf. *A.*, 1937, **I**, 112, 598).—By irradiation from a quartz Hg arc  $D_2$  and CO combine photochemically to give  $CD_2O$ . The infra-red absorption spectrum of  $CD_2O$  between  $2.0$  and  $13.0\ \mu$ . shows seven bands. From these and existing data for  $CH_2O$  the six fundamental frequencies have been assigned, utilising the product ratio connecting the frequencies of isotopic analogues. Valency force consts. for both mols. have been computed. W. R. A.

**Higher harmonics of the C-H vibration in the near infra-red.** A. CARRELLI and P. TULIPANO (*Nuovo Cim.*, 1938, **15**, 1—4).—Three absorption bands of  $CHBr_3$  and two of  $C_6H_6$  have been observed in the region  $5000$ — $15,000\text{ cm}^{-1}$ . The frequencies of the max. of these bands show that they are higher harmonics of the fundamental C-H frequency. Some regularities in these spectra are pointed out. O. J. W.

**Infra-red absorption spectra of trisubstituted benzene derivatives. Symmetry of benzene.** J. LECOMTE (*Compt. rend.*, 1938, **206**, 1568—1570; cf. *A.*, 1938, **I**, 174).— $\nu\nu$  of the principal absorption regions of trisubstituted  $C_6H_6$  derivatives, deduced from measurements on about 70 compounds in the range  $500$ — $1350\text{ cm}^{-1}$ , are given. The results, which confirm previous conclusions as to the six-fold symmetry of  $C_6H_6$ , are discussed in relation to possible modes of vibration of the mols. A. J. E. W.

**Spectroscopy of the far infra-red.** H. M. RANDALL (*Rev. Mod. Physics*, 1938, **10**, 72—85).—A lecture, mainly devoted to apparatus and technique. E. S. H.

**Raman spectra and structure of ozonides. Raman spectra of the ozonides of anethole, estragole, *p*-methoxyphenylacetaldehyde, and  $\psi$ -estragole.** E. BRINER, S. DE NEMITZ, and E. PERROTTET (*Helv. Chim. Acta*, 1938, **21**, 762—766).—Addition of  $O_3$  to aldehydes causes the appearance of frequencies in the region  $1660$ — $1884\text{ cm}^{-1}$  also observed in the Raman spectra of org. anhydrides and peroxides. This is in accord with chemical behaviour, since ozonides combine the properties of anhydrides and peroxides. The frequency of the ethylenic linking decreases in the order anethole > estragole >  $\psi$ -estragole, in accord with previous observations. J. W. S.

**Raman spectrum of ethyl alcohol-water mixtures.** F. CENNAMO (*Nuovo Cim.*, 1938, **15**, 10—13).—With increase of  $[EtOH]$  the intensity of the band at  $3620\text{ cm}^{-1}$ , which is attributed by various authors to simple  $H_2O$  mols., decreases.

O. J. W.

**Raman effect in liquid acetylene.** G. GLOCKLER and M. M. RENFREW (*J. Chem. Physics*, 1938, **6**, 340).—No rotation lines accompanying the strong Raman frequencies of liquid  $C_2H_2$  at  $-75^\circ$  could be detected after an exposure of 16 hr. (cf. *A.*, 1936, 269). A new displacement of  $1259\text{ cm}^{-1}$  is probably the same as the shift of  $1233\text{ cm}^{-1}$  reported for the gas by Bhagavantam and Rao (*ibid.*, 546, 663), and is possibly an overtone of the deformation frequency at  $630\text{ cm}^{-1}$ . Accompanying the  $1961\text{ cm}^{-1}$  line is a weak satellite at  $1934\text{ cm}^{-1}$  which is attributed to  $^{13}CH:^{12}CH$ . Theoretically this isotopic frequency is  $1929\text{ cm}^{-1}$ . No isotopic companion was found for the  $3341\text{ cm}^{-1}$  frequency. The frequencies at  $560\text{ cm}^{-1}$  and  $631\text{ cm}^{-1}$  are also discussed.

W. R. A.

**Raman spectra of deuterioethylenes.** M. DE HEMPTINNE, J. JUNGERS, and J. M. DELFOSSE (*J. Chem. Physics*, 1938, **6**, 319—324; cf. *A.*, 1937, **I**, 549).— $C_2H_4$  was deuterated by two methods. In one, progressive deuteration was effected by the exchange reaction between  $C_2H_4$  and  $D_2O$  in the presence of a catalyst. In the other,  $C_2H_3D$  (*a*),  $(CHD)_2$  (*cis* and *trans*) (*b*), and  $C_2D_4$  (*c*) were prepared in a pure state by reduction of the corresponding dibromide with Zn in  $H_2O$  by the following reactions: (*a*)  $CH_2:CHBr + DBr \rightarrow CH_2Br:CHDBr \rightarrow CH_2:CHD$ ; (*b*)  $CD:CD + 2HBr \rightarrow CHDBr:CHDBr \rightarrow CHD:CHD$ ; (*c*)  $CD:CD + 2DBr \rightarrow CD_2Br:CD_2Br \rightarrow CD_2:CD_2$ . Raman spectra of liquefied  $C_2H_4$ ,  $C_2H_3D$ , *cis*- and *trans*- $(CHD)_2$ ,  $CH_2:CD_2$ ,  $C_2HD_3$ , and  $C_2D_4$  are recorded. Assignments of normal modes of vibration are made, and the effect of isotopic substitution on  $\nu$  is discussed. The product ratio of corresponding  $\nu$  of the two isotopic species is applied and the anharmonicity corrections are deduced. W. R. A.

**Raman effect. LXXXIV. Methyl derivatives.** J. WAGNER (*Z. physikal. Chem.*, 1938, **B**, **40**, 36—50).—Measurements on the Raman spectra of MeCl, MeBr, MeI, MeSH, and MeOH are recorded. The variation of the  $3000$ ,  $2950$ , and  $1430\text{ cm}^{-1}$  frequencies of the Me group in MeX with change in the nature of the substituent X (= Cl, Br, I,  $CH_3$ , OH, SH,  $NH_2$ ) is discussed. The following force consts. are calc.: C-H  $4.96$ , C-Cl  $3.34$ , C-Br  $2.76$ , C-I  $2.26$ , C-C  $4.95$ , C-N  $5.61$ , C-O  $5.73$ , C-S  $3.44$ , all  $\times 10^5$ , dyne/cm.

H. J. E.

**Raman effect. LXXXV. Boric acid and derivatives.** L. KAHOVEC (*Z. physikal. Chem.*, 1938, **B**, **40**, 135—145).—Data are recorded for  $B(OH)_3$ , for esters of the type  $B(OR)_3$ , where R = Me, Et, Pr <sup>$\alpha$</sup> , Pr <sup>$\beta$</sup> , Bu <sup>$\alpha$</sup> , or  $C_5H_{11}^\beta$ , and for  $CH(OMe)_3$ . Ananthkrishnan's data for the Me and Et esters are confirmed (cf. *A.*, 1936, 1179). The restoring force per unit displacement for the OH group in *cryst.*  $H_3BO_3$ , derived from the frequency  $3166\text{ cm}^{-1}$ , is  $5.5 \times 10^5$  dyne/cm. and the radius of the group is  $1.03\text{ \AA}$ . The symmetry of  $H_3BO_3$  is probably  $C_{3h}$ .



The trigonal symmetry persists in liquid  $B(OMe)_3$ , which has a quasicryst. structure. It disappears in the Et and higher esters. In  $B(OMe)_3$  free rotation about the B-O valencies is hindered. H. J. E.

**Raman spectra of organic silicates.** B. V. THOSAR and R. N. BAPAT (Z. Physik, 1938, 109, 472—476).—The Raman spectra of Me, Et,  $Pr^a$ ,  $Bu^a$ , and *isoamyl* silicates (exciting line  $\lambda = 4358$ ) are photographed. The four fundamental frequencies of the  $SiO_4$  tetrahedron are obtained. Two of them are ascribed to asymmetric vibration of the  $SiO_4$  group and vary with the alkyl radical, and two to symmetrical vibrations along the Si-O bond, weakening but not changing in frequency, in the order Me  $\rightarrow$  *isoamyl*. L. G. G.

**Raman effect and problems of constitution.** XI. Glyoxaline.—See A., 1938, II, 294.

**Raman effect in solid cyclohexane.** S. M. MITRA (Phil. Mag., 1938, [vii], 25, 895—899).—New frequencies observed at 60 and 105  $cm^{-1}$  were characteristic of the solid. Each of the lines at 1266 and 1437  $cm^{-1}$  in the liquid was split into two in the spectrum from the solid; the 2922  $cm^{-1}$  line was broadened and other lines were unchanged in the solid. H. J. E.

**Reflexion coefficients of certain organic substances.** J. A. M. VAN LIEMPT (Rec. trav. chim., 1938, 57, 694—696).—With the aid of a sublimation-pressure formula (A., 1936, 21) reflexion coeffs. can be calc. from Raman frequencies and sublimation pressure data. The vals. of the coeffs. of  $C_6H_6$ ,  $p-C_6H_4Br_2$ , and  $C_{10}H_8$  are all between 0.99 and 1.0. W. R. A.

**Resolution of luminescent spectra excited by ultra-violet light.** J. EWLES (Proc. Leeds Phil. Soc., 1938, 3, 416).—The resolved luminescent bands of CaO excited by cathode rays are also obtained under ultra-violet light excitation. There appears to be a slight shift towards the red, but the frequency difference of 500  $cm^{-1}$  is maintained. F. J. L.

**Fluorescence and absorption of  $Pr^{+++}$  and  $Eu^{+++}$ .** II. H. LANGE (Ann. Physik, 1938, [v], 32, 361—377; cf. A., 1938, I, 293).—Fluorescence spectra of  $Eu^{+++}$  in various salts crystallising in different systems were measured at  $-180^\circ$ . Absorption spectra were measured at  $20^\circ$  and  $-180^\circ$ . The phosphorescence of mixed phosphors containing alkaline-earth + Eu sulphates varied according to the uniformity of the prep. Results are discussed in relation to splitting of the ground terms of  $Eu^{+++}$  in the crystal field. H. C. G.

**Cathodo-luminescence spectrum of samarium in solid calcium compounds.** E. IWASE (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, 34, 487—503; cf. A., 1934, 345; 1938, I, 176).—Spectra for the Ca salts (calcined with  $SmCl_3$  at  $800^\circ$ ) of the anions  $SiO_3''$ ,  $SO_4''$ ,  $PO_4''$ ,  $WO_4''$ ,  $MoO_4''$ ,  $F'$ ,  $O'$ ,  $Al_2O_4''$ , and  $B_2O_4''$  have been measured in the visible, and compared with similar data, chiefly by Bruninghaus and by Urbain. Sharp bands, usually in 3 groups, vary in  $\lambda$  and intensity with the anion. The extent to which the nature of an activator in natural

minerals may be safely inferred from such spectra is illustrated from scheelite, fluorite, and apatite.

I. McA.

**Rectifying properties of crystals.** R. DEAGLIO (Nature, 1938, 141, 1011).—A discussion (A., 1938, I, 120). L. S. T.

**Measurements on complex photo-cathodes.** P. GÖRLICH (Z. Physik, 1938, 109, 374—386).—Transparent films of Bi or Sb were deposited on  $Ag_2O$  layers and Cs was allowed to act. Photoelectric current- $\lambda$  relationships are obtained for the resulting complex photo-cathodes, and from the curves conclusions were drawn as to the mechanism of electron emission. L. G. G.

**Semi-conductor in an alternating current.** G. DÉCHÈNE (Compt. rend., 1938, 206, 1558—1560).—A method for determining the effective capacity of the contact between a conductor and a semi-conductor (cf. A., 1938, I, 296), using a.c., is described. A. J. E. W.

**Electrical conductivity and thermoelectric properties of semi-conductors.** B. M. HOCHBERG and M. S. SOMINSKI (Physikal. Z. Sovietunion, 1938, 13, 198—223).—Measurements were made of thermoelectric power for the junction Cu-semi-conductor for the semi-conductors  $WO_3$ ,  $V_2O_5$ , CuO, Se,  $MoS_2$ , SiC,  $Bi_2S_3$ ,  $Tl_2S$ , and CoO. Comparative measurements of the temp. coeffs. of the electrical conductivity and of the thermoelectric power have been made. A discontinuous variation in direction and magnitude of the thermoelectric power of  $Tl_2S$  with its state of oxidation and a similar variation with temp. have been observed. It is concluded that both electron and positive hole diffusion are active in the conductivity of semi-conductors. O. D. S.

**Conductivity law of semi-conductors.** F. MÖGLICH (Z. Physik, 1938, 109, 503—509).—Conductivity in semi-conductors is shown to be a consequence of an internal ionisation releasing mobile electrons. The nature of this ionisation is discussed. L. G. G.

**Dielectric constant of ionised gases.** II. S. GANGOPADHYAYA and S. R. KHASTGIR (Phil. Mag., 1938, [vii], 25, 883—895; cf. A., 1937, I, 347).—Measurements for ionised air and  $N_2$  are given. At const. tube current the dielectric const. of ionised air decreases  $\propto \lambda^2$  to a min. val., and then increases. H. J. E.

**Temperature-dependence of the dielectric constant of the gaseous mixture  $NO_2 \rightleftharpoons N_2O_4$  and the electric moment of  $NO_2$  and  $N_2O_4$ .** R. W. SCHULZ (Z. Physik, 1938, 109, 517—537).— $\epsilon$  for  $NO_2 \rightleftharpoons N_2O_4$ , prepared from  $Pb(NO_3)_2$ , was determined by a heterodyne method over a temp. range of  $70^\circ$  and at pressures up to 600 mm. Hg. Results are in conflict with those of Williams (cf. A., 1936, 408). The moments of  $NO_2$  and  $N_2O_4$  are respectively 0.29 and 0.37 D. L. G. G.

**Calculation of the permanent electric moment of some alkali halides.** P. TRAUTTEUR (Nuovo Cim., 1938, 15, 5—9).—The vals. of  $\mu$ , calc. by means of Debye's formula, for CsI, KCl, and RbBr are 13.7—14.0, 12.8, and 13.5 D., respectively. The differences



in these vals. from those of  $\mu_{\text{obs}}$ . are attributed to deformation of the outer electronic shells of the constituent ions.

O. J. W.

**Dipole moment and structure of morpholine.** J. R. PARTINGTON and D. I. COOMBER (Nature, 1938, 141, 918).—The dipole moment (in  $\text{C}_6\text{H}_6$  at  $20^\circ$ ) is 1.48 D. The two Sachse *Z*-forms, the two symmetrical and the two unsymmetrical *U*-forms which are possible, are shown diagrammatically. Moments are calc. for these structures and the val. 1.48 agrees with either of the two *Z*-forms, whilst comparison with the results for dioxan indicates that this is the most probable interpretation. The possibility of small amounts of the four *U*-forms is not excluded.

L. S. T.

**Chemical war materials. VII. Dipole moments of nose- and throat-irritant materials (blue cross war materials). VIII. Dipole moments of lung poisons (green cross war materials). IX. Dipole moments of skin poisons (yellow cross war materials).** H. MOHLER (Helv. Chim. Acta, 1938, 21, 784—786, 787—788, 789—792; cf. A., 1938, I, 121).—From measurements on dil. solutions in  $\text{C}_6\text{H}_{14}$  or  $\text{C}_6\text{H}_6$  the following dipole moments (in D.) have been determined:  $\text{AsPh}_3\text{Cl}$  2.70,  $\text{AsPh}_3\text{CN}$  4.19, phenarsazine chloride 2.26,  $\text{ClCO}_2\text{Me}$  2.22,  $\text{ClCO}_2\text{CCl}_3$  2.16,  $\text{CCl}_3\text{NO}_2$  1.91,  $\text{AsEtCl}_2$  2.51,  $\text{CHCl:CHAsCl}_2$  1.77,  $(\text{CHCl:CH})_2\text{AsCl}$  1.45,  $\text{As}(\text{CH:CHCl})_3$  0.39,  $(\text{CH}_2\text{Cl:CH}_2)_2\text{S}$  1.76. J. W. S.

**Dielectric constant and conductivity of soil at high radio frequencies.** S. S. BANERJEE and R. D. JOSHI (Phil. Mag., 1938, [vii], 25, 1025—1033).—Measurements have been made by determining the actual attenuation of the waves in the soil. Conductivity increases with frequency and moisture content and is of the order  $10^6$  e.s.u. Dielectric const. falls with rise of frequency but rises with moisture content from 4.5 with 6.3%  $\text{H}_2\text{O}$  to 17.3 with 13.9%. Change of the attenuation const. is not very regular but is usually higher for moist soil and high frequencies. For Indian soil both conductivity and dielectric const. are < for soil from other countries.

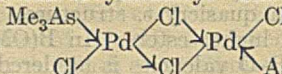
T. H. G.

**Necessary corrections of the modern theory of complex compounds.** B. ORMONT (J. Phys. Chem. Russ., 1938, 11, 274—277).—When establishing a theory of complex compounds the nuclei must be taken into account; the theories considering electrons only are insufficient.

J. J. B.

**Constitution of complex metallic salts. VII. Structure and configuration of the bridged derivatives of trimethylarsine with palladous halides.** F. G. MANN and A. F. WELLS (J.C.S., 1938, 702—710; cf. A., 1936, 1496).—The bridged derivatives of the trialkyl-phosphines and -arsines with  $\text{Pd}^{II}$  halides, e.g.,  $[\text{PR}_3\text{PdCl}_2]_2$ , exist in the solid state, in only one of three possible isomeric forms which, in org. solvents, are all present in tautomeric equilibrium. The isomorphous members,  $[\text{AsMe}_3\text{PdCl}_2]_2$  (I) and  $[\text{AsMe}_3\text{PdBr}_2]_2$  (II), have been examined crystallographically. The mols. are planar, and the crystal is built up from parallel layers of such mols.;

they possess a diad axis of symmetry. The structure of

(I) accordingly is . The

unit cell contains 4 mols., and their orientation in the crystal, interat. distances, and bond angles have been determined. Differences in the types of crystals of (I) and (II) obtained from EtOH and from dioxan, are discussed.  $[\text{AsMe}_3\text{PdClBr}]_2$  (III),  $[\text{AsMe}_3\text{PdCl}(\text{SCN})]_2$ , and  $[\text{AsMe}_3\text{PdBr}(\text{SCN})]_2$  have been prepared and the nature of the bridging in each is discussed. Three cryst. forms of (III) have been obtained and examined. The phosphine analogue of (I) is not isomorphous with (I). The existence of the bridged linking of metallic atoms through acid radicals is reviewed briefly and it is shown that the groups  $-\text{Cl}-$ ,  $-\text{O}-$ ,  $-\text{OH}-$ ,  $-\text{S}-$ ,  $-\text{SEt}-$ ,  $-\text{SCN}-$ ,  $-\text{NH}_2-$ , and  $-\text{NH}-$  can all give 4-membered rings when two such groups bridge two metallic atoms, whilst, under similar circumstances, rings containing >4 atoms are formed with the groups  $-\text{O}-\text{CMe}=\text{O}-$ ,  $-\text{O}-\text{SO}_2-\text{O}-$ ,  $-\text{O}-\text{SO}_2-\text{S}-$ ,  $-\text{N}(\rightarrow\text{O})=\text{O}-$ , and  $-\text{O}-\text{O}-$ . An improved prep. of  $\text{PMe}_3$  and of dichlorobis(trimethylarsine)palladium,  $[(\text{AsMe}_3)_2\text{PdCl}_2]_2$ , is given. The following are described: *dibromobis(trimethylarsine)palladium*,  $[(\text{AsMe}_3)_2\text{PdBr}_2]_2$ , m.p.  $229^\circ$ ; *dibromobis(trimethylarsine)- $\mu$ -dibromodipalladium* [= (II) above], decomp.  $258-260^\circ$  with previous darkening but without melting; *dichlorobis(trimethylarsine)- $\mu$ -dibromodipalladium* [= (III) above], darkened on heating at  $230^\circ$  and had decomposed at  $248^\circ$ ; *dithiocyanatobis(trimethylarsine)palladium*,  $[(\text{AsMe}_3)_2\text{Pd}(\text{SCN})_2]_2$ , m.p.  $124^\circ$ ; *dihalogenobis(trimethylarsine)- $\mu$ -dithiocyanatodipalladium*,  $[\text{AsMe}_3\text{PdX}(\text{SCN})]_2$ , X = Cl, m.p.  $192-193^\circ$  (decomp.), Br, m.p.  $189-190^\circ$  (decomp.); *dinitrobis(trimethylarsine)palladium*,  $[(\text{AsMe}_3)_2\text{Pd}(\text{NO}_2)_2]_2$ , m.p.  $234^\circ$  (decomp.); *dichlorobis(trimethylarsine)- $\mu$ -dinitrodipalladium*,  $[\text{AsMe}_3\text{Pd}(\text{NO}_2)\text{Cl}]_2$ , m.p.  $186-188^\circ$  (decomp. after softening); *dichlorobis(trimethylphosphine)palladium*,  $[(\text{PMe}_3)_2\text{PdCl}_2]_2$ , m.p.  $282^\circ$  (decomp.); *dichlorobis(trimethylphosphine)- $\mu$ -dichlorodipalladium*,  $[\text{PMe}_3\text{PdCl}_2]_2$ , m.p.  $285^\circ$  (decomp.); *di-iodobis(trimethylphosphine)- $\mu$ -di-iododimercury*,  $[\text{PPr}^a_3\text{HgI}_2]_2$ , occurs in two forms, white, m.p.  $114^\circ$ , and yellow, convertible into the white form by heating.

W. R. A.

**Dimensional considerations in continuum physics.** R. FÜRTH (Ann. Physik, 1938, [v], 32, 336—346).—Dimensions of physical consts. for the reversible and irreversible properties of matter in the solid, liquid, and liquid-cryst. states are discussed.

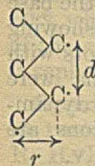
H. C. G.

**Most probable excitation energy of the hydrogen molecule observed experimentally.** S. G. COLES and R. WHIDDINGTON (Proc. Leeds Phil. Soc., 1938, 3, 401—402).—Using the magnetic spectrum method vals. between 12.4 and 12.9 v. are deduced from observation of the "loss band." F. J. L.

**Internuclear distance in the fluorine molecule.** L. O. BROCKWAY (J. Amer. Chem. Soc., 1938, 60, 1348—1349).—Electron-diffraction measurements give  $1.45 \pm 0.05$  Å., which is about 14% > the val. expected for a normal, single covalent linking. E. S. H.



Length of aliphatic carbon [C-C] link. C. H. MACGILLAVRY (Z. Krist., 1938, 98, 407-410).—



Assuming the plane zig-zag C chain (fig.), the C-C link is determined from  $d$  and  $r$ . Müller's (X-ray)  $r$  and interpretation are questioned; the val.  $0.82 \pm 0.11$  Å., determined from Müller's cell dimensions and Trillat's electron diffraction ( $hkl$ ) intensities for a long-chain  $n$ -paraffin, accords with Hengstenberg's X-ray val. With  $d$  2.54 Å. (X-ray), C-C is thus  $1.52 \pm 0.07$  Å.

I. McA.

Deformations of valency angles according to absorption spectra; structures of benzocyclanones, their oximes, and benzocyclenes.—See A., 1938, II, 327.

Surface tension of liquid helium. J. F. ALLEN and A. D. MISENER (Proc. Camb. Phil. Soc., 1938, 34, 299-300).—The surface tension of liquid He between  $1^\circ$  and  $5^\circ$  K. has been measured by the capillary-rise method. There is no apparent discontinuity at the transition point. F. J. L.

Computation of three-dimensional Fourier syntheses in crystal structure analysis. T. H. GOODWIN and R. HARDY (Phil. Mag., 1938, [vii], 25, 1096-1104).—Complete resolution of all the atoms in a unit cell may not be possible from two-dimensional Fourier projections but must result from three-dimensional syntheses if sufficient terms are used. The stages by which such syntheses are carried out are described for the most general (completely asymmetric) case and special attention is given to summations over planes such as  $(xyz_1)$  and along lines such as  $(x_1y_1z)$ . T. H. G.

Intense monochromatic beams of X-rays. I. FANKUCHEN (Physical Rev., 1938, [ii], 53, 910; cf. A., 1937, I, 152).—An amplification of discussions by Bozorth (cf. A., 1938, I, 300). N. M. B.

New type of X-ray diagram. A. GUINIER (Compt. rend., 1938, 206, 1641-1643).—The occurrence of diagrams containing straight lines or diffuse spots of low intensity radiating irregularly from the central spot is described. Such diagrams have been obtained with a supersaturated Al-Cu solid solution, using monochromatic radiation; in this case they may be due to reflexion at plane aggregates of Cu atoms of small thickness, distributed irregularly but parallel to each other throughout the crystal. The diameter ( $\sim 150$  Å.) and thickness ( $\sim 3-4$  Å.) of these aggregates can be deduced from the diagram obtained. A. J. E. W.

Radial lines in Laue spot photographs. (A) A. P. R. WADLUND. (B) W. H. ZACHARIASEN (Physical Rev., 1938, [ii], 53, 843, 844).—(A) Unexplained radial lines with marked structure have been observed on Laue photographs only in the case of NaCl and KCl crystals.

(B) It is suggested that the lines are due to two-dimensional lattice effects, observable in the case of NaCl and KCl owing to the pronounced mosaic character of the crystals. A mathematical treatment is developed. N. M. B.

Detection of lattice disturbances and determination of particle sizes with X-rays. R. FROCKE (Z. Elektrochem., 1938, 44, 291-295).—The effect of various types of lattice disturbances, of small size of primary particles, and of admixture of amorphous material on the widths and intensities of X-ray lines are discussed. F. J. G.

Structure of the real crystal system. D. BALAREV (Österr. Chem.-Ztg., 1938, 41, 235-242).—The author's views on the non-homogeneity of real crystals are summarised and discussed. J. W. S.

Velocity of crystallisation of sodium and the connexion between the atomic heat of fusion and velocity of crystallisation of the elements. J. CZOCHRALSKI and W. GARLIČKA (Wiadom. Inst. Met., 1936, 3, 39-44; Chem. Zentr., 1936, ii, 1845).—The velocity of crystallisation of Na, melted under xylene, increases with temp. Dendritic crystals are obtained below  $98^\circ$ , and cylindrical crystals above this temp. Comparison of the atm. heat of crystallisation and velocity of crystallisation of Au, Al, Sn, Pb, and Na shows that velocity decreases with increasing heat of crystallisation. L. S. T.

Quasi-crystalline and crystalline liquids. F. C. FRANK (Physikal. Z., 1938, 39, 530-534).—Theoretical. Two non-adjacent mols. can only remain parallel to one another if there is a "chain" of parallel mols. between them. The maintenance of the parallelism is dependent on the ratio of the probabilities of branching and of rupture of the "chain." If this is  $< 1$  the parallelism is limited to a finite range, whereas if it is equal to 1 it may go on indefinitely. The effect of small deviations from parallelism is considered. A. J. M.

Precision determination of lattice constants of hygroscopic compounds (LiCl, NaBr). A. IEVŅŠ, M. STRAUMANIS, and K. KARLSONS (Z. physikal. Chem., 1938, B, 40, 146-150; cf. A., 1936, 273).—Precautions necessary for the prep. of the specimen and for its examination by the powder method are described. The lattice consts. of LiCl and NaBr at  $25^\circ$  are  $5.12952 \pm 0.00004$  Å. and  $5.96095 \pm 0.00005$  Å., respectively. The expansion coeffs. are  $44.76 \times 10^{-6}$  and  $42.52 \times 10^{-6}$ , respectively. H. J. E.

Configuration of a pentahalogen anion group from the X-ray structure determination of potassium tetrachloroiodide crystals. R. C. L. MOONEY (Z. Krist., 1938, 98, 377-393; cf. A., 1938, I, 347).—By Laue and oscillation X-radiograms, the monoclinic cell of  $KICl_4$  contains 4 mols, with  $a$  13.09,  $b$  14.18,  $c$  4.20 Å.,  $\beta$   $95^\circ 7'$ ;  $\rho_{calc}$ . 2.62; space-group  $C_{2h}^2 (P2_1/m)$ . Complete at. parameters and interdistances are determined in fair agreement with  $> 200$  visual intensities. In the complex  $(ICl_4)'$  anion, 4 Cl at the corners of a square are linked to a central coplanar I by quadricovalency at 2.34 Å. The structure, which involves a close-packing of  $(ICl_4)'$  with a loose 6-co-ordination of K-Cl (at  $\sim 3.32$  Å.), is discussed in relation to binding and stability. I. McA.

Oxygen parameters for [crystal structure of]  $NaIO_4$ . E. A. HAZLEWOOD (Z. Krist., 1938, 98,



439—446).—The tetragonal cell has  $a$  5.3222 ± 0.0004,  $c$  11.93 Å.; the space-group  $C_{4h}^2$  (A., 1938, I, 125) is confirmed. The  $O$  parameters,  $x$  0.220,  $y$  0.159,  $z$  0.089, derived from analysis of  $(00l)$  and  $(hkl)$  integrated intensities (using a spectrometer with Geiger-Müller counter, amplifier, and thyratron system) are confirmed by sensitive analysis of oscillation photographs. Each Na is 8-co-ordinated to equidistant  $O$  at 2.575 Å.  $(IO_4)'$  is a regular tetrahedron ( $O$  at corners, central  $I$ ) with  $I-O$  1.792,  $O-O$  2.67 Å. I. McA.

**Structure of sodium isocyanate.** M. BASSIÈRE (Compt. rend., 1938, 206, 1309—1311).—The structure is analogous to that of  $NaN_3$ . The unit cell, containing one mol., has  $a$  3.576,  $c$  15.10 Å.; space-group  $C_{3v}^2$  or  $R3m$ . The at. parameters give the interat. distances  $C-N$  1.21,  $C-O$  1.13 Å., and confirm that the  $CNO$  group is linear and has the structure  $\cdot N:C:O$ . A. J. E. W.

**Crystal structure of acetaldehyde-ammonia** " $CH_3CHO \cdot NH_3$ ." N. F. MOERMAN (Z. Krist., 1938, 98, 447—455).— $X$ -Ray analysis shows the rhombohedral cell with  $a$  8.36 Å.,  $\alpha$  84°, to contain 6  $C_2H_5ON$ ;  $\rho$  1.06; space-group  $D_{3d}^5$ . A structure, with approx. parameters and interdistances for the groups  $CH$ ,  $NH$ ,  $H_2O$ , and  $Me$ , is determined in accord with chemical facts and crystal symmetry, optics, cleavage, cell dimensions, and estimated  $X$ -ray intensities. 6  $H_2O$  linked by the ice-type  $OH$  bond (Bernal, A., 1934, 13) form a central puckered  $O$ -hexagon (I) (angle  $O-O-O \sim 110^\circ$ ) between 2 normally bonded "armchair" hexagon trimers ( $CHMe \cdot NH_3$ ) (II), with the  $Me$  outside. 3  $N$  of each of (II) are linked by  $H$  bonds to alternate  $O$  of (I). I. McA.

**$X$ -Ray analysis of definite single crystals of cetyl palmitate.** R. KOHLHAAS (Z. Krist., 1938, 98, 418—438; cf. A., 1937, I, 502).—Thermal and optical analysis from 20° to 54° (m.p.) shows no structural transitions in crystals obtained from amyl butyrate. From Laue, rotation, and Schiebold-Sauter  $X$ -radiograms, the monoclinic cell has  $a$  5.61,  $b$  7.42,  $c$   $\sin \beta$  77.88 Å.,  $\beta$  61.3°;  $\rho$  0.989; 4 mols. per cell; space-group probably  $C_{2h}^2 - P2_1/c$ . Discussion of the structure is based on some 140 indexed intensities. Dicycyl ether is monoclinic with  $a$  5.49,  $b$  7.45,  $c$   $\sin \beta$  38.97 Å.,  $\beta$  63.2°;  $\rho$  0.978. I. McA.

**Calibration substances for electron diffraction.** N. A. SCHISCHACOV (Physikal. Z. Sovietunion, 1937, 12, 20—22).—Choice of standard specimens for determination of  $\lambda$  in electron diffraction experiments is described. Two-dimensional crystals of  $Si_2O_5$  are recommended and the method of prep. is given. The hexagonal lattice const.  $a = 5.161$  Å. ( $\pm 0.3\%$ ). J. A. D.

**Molecular structure of selenium dioxide vapour.** K. J. PALMER and N. ELLIOTT (J. Amer. Chem. Soc., 1938, 60, 1309—1310).—Electron-diffraction data yield the val.  $1.61 \pm 0.03$  Å. for the  $Se-O$  distance. E. S. H.

**Electron diffraction by  $Sb_2O_3$  on  $Sb_2S_3$ .** S. MIYAKE (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, 34, 565—583).—Reflexion photographs from

oxidised  $Sb_2S_3$  gave three types of patterns according to the heating: (1) ring patterns of  $Sb_2O_3$ ; (2) spot patterns of  $Sb_2O_3$ , oriented along the lattice of the base crystal; (3) ring patterns from  $Sb_2O_4$  also showing evidence of orientation. Forbidden spots, spots with irrational indices, and refraction phenomena were observed and are discussed in terms of Laue's dynamical theory of diffraction. Crystal dimensions are estimated; the inner potential of  $Sb_2O_3$  is 17 v. J. A. D.

**Ferromagnetic anisotropy of nickel-iron crystals at various temperatures.** J. D. KLEIS (Physical Rev., 1938, [ii], 53, 848; cf. A., 1937, I, 120).—A correction. N. M. B.

**Effect of lattice discontinuities on the magnetic properties of magnetite.** D. J. DOAN (U.S. Bur. Mines, 1938, Rept. Invest. 3400, 65—86).—The magnetic properties of magnetite were studied in view of the possibility of developing separation in an alternating magnetic field. The relation between lattice structure and magnetic properties is discussed. A  $Fe_3O_4-Fe_2O_3$  mixture (prepared by heating  $Fe_2O_3$ ) showed max. "age-hardening" effects at 400—700°, the behaviour being similar to that of  $Fe$  alloys. The magnetic properties of  $Fe_3O_4$ , made by reducing  $Fe_2O_3$ , are correlated with the  $X$ -ray structure. The coercive form of the product is related to the reducing temp. and the type of gas used. The magnetic effects of applied mechanical stresses were observed. S. J. K.

**Deformation of crystalline matter.** A. PISTOCCHI (Alluminio, 1938, 7, 3—13).—A general survey of interat. forces in crystals. O. J. W.

**Plastic deformation of rock-salt. IV.** N. A. BRILLIANTOV and I. V. OBREIMOV (Physikal. Z. Sovietunion, 1937, 12, 7—19; cf. A., 1935, 1311).—A method of obtaining large twins of  $NaCl$  by plastic deformation is described. Optical measurements of the angle between the facets are compared with  $X$ -ray measurements of the angles between the twinned crystals and show that pure translation does not occur. When  $NaCl$  is deformed a birefringent stripe appears as boundary between the twins, and this stripe is coloured more intensely by  $X$ -rays than the rest of the crystal. J. A. D.

**Liquid crystals and anisotropic solutions.** A. S. C. LAWRENCE (J. Roy. Microscop. Soc., 1938, [iii], 58, 30—48; cf. A., 1933, 1108).—A lecture. I. McA.

**Contact potential between liquid and solid zinc at the m.p.** H. KURZKE and J. ROTTGARDT (Z. Physik, 1938, 109, 341—348).—The contact p.d. between liquid and solid  $Zn$ , determined from measurements of photoelectric saturation currents, is  $\sim -0.2$  v. H. C. G.

**Sintering of metal powders.** G. GRUBE and H. SCHLECHT (Z. Elektrochem., 1938, 44, 367—374).—Data are recorded for the influence of sintering temp. on the density, electrical conductivity, Brinell hardness, and tensile strength of powders of  $Mo$  and  $Ni$  compressed at pressure  $>10,000$  kg. per sq. cm. C. R. H.

**Electrical resistances of the alkali metals.** M. LEMARCHANDS and L. ROUGEOT (Bull. Soc. chim.,



1938, [v], 5, 910—915).—The sp. resistances ( $\rho$ ) of solid K, Rb, and Cs at temp.  $T$  can be expressed by relations of the form  $\rho = 2\sqrt{\gamma} \cdot ZT_f / T(1 + T/2T_f) \times 10^{-6}$ , where  $T_f$  is the m.p.,  $Z$  the at. no., and  $\gamma$  the ratio of the sp. heats. This relation holds also for Na if  $Z$  is replaced by  $Z + 1$ . J. W. S.

**Specific resistance and temperature variation of resistance of tin crystals.** B. CHALMERS and R. H. HUMPHRY (Phil. Mag., 1938, [vii], 25, 1108—1113).—Measurements have been made with the  $c$ -axis parallel and perpendicular to the axis of single crystals of  $\beta$ -Sn (purity 99.987% and 99.996%). The effect of this difference in purity is only just perceptible but is greater in the "parallel" experiments. T. H. G.

**Measurements on selenium photo-elements.** H. SCHWEICKERT (Z. Physik, 1938, 109, 413—430).—Resistance and capacity measurements on Se photoelectric cells prove the existence of a boundary layer the properties of which determine the total electrical output and the observed e.m.f. on illumination. In contradiction to other authors, change of resistance of the boundary layer is not observed on illumination and this fact allows the determination of the energy distribution of electrons from the covering electrode. The quantum yield on short-circuit is between 0.5 and 1.0. L. G. G.

**Magnetism and chemistry.** H. HARALDSEN (Tids. Kjem., 1938, 18, 69—74).—A review. M. H. M. A.

**Magnetism and valency of the atoms in metallic phases.** E. VOGT (Angew. Chem., 1938, 51, 361—365).—A review of the characteristics and causes of the types of magnetism occurring in metals and alloys. The topics discussed include the magnetism of the rare-earth and transition metals, and electron transfers occurring on formation of alloys. A. J. E. W.

**Theory of the magnetic anisotropy of cubic crystals at the absolute zero.** W. F. VAN PEYPE (Physica, 1938, 5, 465—482).—An extension of previous work (A., 1931, 1003), based on Heisenberg's theory. A. J. E. W.

**Time of relaxation due to spin-spin interaction in paramagnetic crystals.** R. DE L. KRONIG and C. J. BOUWKAMP (Physica, 1938, 5, 521—528; cf. A., 1933, 117).—Theoretical. A. J. E. W.

**Paramagnetic relaxation in iron ammonium alum at low temperatures.** W. J. DE HAAS and F. K. DU PRÉ (Physica, 1938, 5, 501—506).—The differential magnetic susceptibility  $\chi'$  of  $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$  has been measured at 1.22 and 1.65° K., using a small a.c. field (frequency  $\nu$ ) superposed on a parallel const. field.  $\chi'$  shows considerable dependence on  $\nu$  for  $\nu \sim 15$  cycles, and it is concluded that the relaxation time for the spin-lattice equilibrium is  $\ll$  the val. (100 sec.) predicted by Heitler and Teller (A., 1936, 1191).  $\chi'$  is not measurably decreased by a transverse const. field. A. J. E. W.

**Thermodynamic interpretation of paramagnetic relaxation phenomena.** H. B. G. CASMIR and F. K. DU PRÉ (Physica, 1938, 5, 507—511).—The results of experiments with  $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$  (cf. preceding abstract) are considered. The relaxation

C C\*\* (A., I.)

time,  $\tau$ , of the spin-lattice equilibrium is  $0.2\text{--}2 \times 10^{-2}$  sec. in a magnetic field of 0—2500 gauss.

**Magnetic susceptibility of liquid nitric oxide, NO.** H. BIZETTE and B. TSAÏ (Compt. rend., 1938, 206, 1288—1289).— $\kappa = 3.53 \times 10^{-6}$  c.g.s. unit at  $-163^\circ$ . This val. indicates that liquid NO at  $-163^\circ$  is 97% polymerised to  $(\text{NO})_2$  (cf. also A., 1937, I, 397). A. J. E. W.

**Magnetic anisotropy of some mixed Tutton salts.** M. S. JOGLEKAR (Z. Krist., 1938, 98, 411—417; cf. A., 1936, 1057).—To determine the effect of the cryst. electric field on the anisotropy of paramagnetic ions, mixed crystals  $P + nD$  ( $n$  by analysis) have been prepared from the isomorphous  $\text{MSO}_4 \cdot (\text{NH}_4)_2 \cdot \text{SO}_4 \cdot 6\text{H}_2\text{O}$  ( $M = \text{Fe, Co, Ni, or Cu}$ : paramagnetic  $P$ ;  $M = \text{Mg or Zn}$ : diamagnetic  $D$ ) and  $\chi_1 - \chi_2$ ,  $\chi_1 - \chi_3$ , and  $\psi$  (A., 1933, 664) measured at  $30^\circ$  in a uniform magnetic field. The effect of magnetic dilution on the anisotropies is most marked in Co, and for Mg and Zn on Co or Fe is in opposite senses, as expected from the ionic radii. I. McA.

**Magnetic anisotropies and molecular orientations in crystals of acenaphthene.** J. SHANKER and M. PRASAD (Current Sci., 1938, 6, 554—555; cf. A., 1938, I, 68).—Assuming isotropic  $>\text{CH}_2$  contributions, mol. susceptibilities,  $K_{1, 2, 3}$  for acenaphthene of  $-74.9$ ,  $-72.7$ , and  $-187.8$  (all  $\times 10^{-6}$ ), respectively, are derived from corr. vals. (A., 1937, I, 18) for  $\text{C}_{10}\text{H}_8$ . These confirm a mol. axis of symmetry parallel to [010], and give  $37^\circ 30'$  for the angle ( $\alpha$ ) between the mol. plane and (001). In a comparison with a like analysis by Banerjee and Sinha (A., 1937, I, 289), the (X-ray)  $\alpha$  val.  $26^\circ$  is questioned. I. McA.

**Velocity of sound in liquid helium.** E. F. BURTON (Nature, 1938, 141, 970—971).—Determinations of the velocity of sound in He I and He II are recorded in a curve showing the change in velocity with temp. The velocity at points somewhat removed from the  $\lambda$ -point agrees approx. with the vals. calc. from estimated adiabatic elasticities. The occurrence of the discontinuity expected at this point is doubtful. L. S. T.

**Velocity of sound in liquid nitrogen.** E. HIRSCHLAFF (Proc. Camb. Phil. Soc., 1938, 34, 296—298).—The velocity of sound in liquid  $\text{N}_2$  at  $75\text{--}55^\circ$  K. has been determined by measuring the distance between the interference fringes formed when standing supersonic waves set up in the liquid by means of a piezo-electric quartz are illuminated with Hg light  $\lambda = 5461 \text{ \AA}$ . F. J. L.

**Reflexion of sound.** K. F. HERZFELD (Physical Rev., 1938, [ii], 53, 899—906).—Mathematical. The losses in the reflexion of sound on solids are investigated. The heat conduction of the solid disturbs the temp. distribution in the gas and sets up a temp. wave. Effects which become important only at higher frequencies (scattering of the mols. on the wall, scattering of the sound wave by uneven places) and the effect of adsorption are also investigated. N. M. B.

**Transparency of solid plates to ultrasonic waves.** E. BAUMGARDT (Compt. rend., 1938, 206,



1284—1286).—Vals. of Young's modulus for Fe and mild steel, deduced from the optimum thickness of plates transparent to ultrasonic waves, are independent of the frequency and are in agreement with the static vals. The velocity of propagation through plates is thus equal to that in an extended medium.

A. J. E. W.

**Thermal equilibrium at temperatures below 1° K.** E. S. SHIRE (Proc. Camb. Phil. Soc., 1938, 34, 301—307).—The time for thermal equilibrium between the ionic magnets and the lattice vibrations of Fe NH<sub>4</sub> alum crystals is <0.5 sec. for all temp. above 0.025° K.

F. J. L.

**Collective electron energy and specific heat.** E. C. STONER (Phil. Mag., 1938, [vii], 25, 899—926).—Theoretical.

H. J. E.

**Specific heats and heat of fusion of iodine.** K. J. FREDERICK and J. H. HILDEBRAND (J. Amer. Chem. Soc., 1938, 60, 1436—1439).—The heat of fusion, determined by the method of mixtures, is 3740±20 g.-cal. per mol. The mol. heat capacity of solid I at 25—113.6° is given by  $c_p = 13.07 + 3.21 \times 10^{-4}(t - 25)^2$ ; that of liquid I from the m.p. to 160° is 19.5±0.3 g.-cal.

E. S. H.

**Specific heat of the alkalis.** L. G. CARPENTER, T. F. HARLE, and C. J. STEWARD (Nature, 1938, 141, 1015—1016).—Measurements of the true sp. heat of K between -70° and 336° show the normal tendency to reach a const. val. ~3R, followed by an abnormal rise of sp. heat commencing at room temp. and extending to the m.p. The abnormal rise of sp. heat extending over a considerable range below the m.p. appears to be common to K, Li, and Na.

L. S. T.

**Heat of formation and specific heat of tantalum nitride.** S. SATOH (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, 34, 477—486; cf. A., 1934, 966).—Using TaN containing 6.50% of free Ta, measurements (cf. A., 1936, 565) over the intervals 0—100°, 0—305°, and 0—500° give for the mean sp. heat of pure TaN the vals. 0.05117, 0.05683, and 0.06068, respectively, whence the sp. heat-temp. relation:  $C = 0.04785 + 7.068 \times 10^{-5}t - 5.808 \times 10^{-8}t^2$ . Using this, the Nernst heat theorem, and high-temp. equilibrium data (by Andrews), Ta + N = TaN + 58.65 kg.-cal. at 25°, confirming Neumann *et al.* The heats of formation of nitrides are discussed in relation to at. no.

I. McA.

**Sulphur dioxide. Heat capacity of solid and liquid. Vapour pressure. Heat of vaporisation. Entropy values from thermal and molecular data.** W. F. GLAUQUE and C. C. STEPHENSON (J. Amer. Chem. Soc., 1938, 60, 1389—1394).—Heat capacity data from 15° K. to the b.p. are recorded. SO<sub>2</sub> has m.p. 197.64° K., b.p. 263.08° K., heat of fusion 1769.1 g.-cal. per mol., heat of vaporisation 5960 g.-cal. per mol. The v.p. from m.p. to b.p. is given by  $\log_{10} P_{\text{(internat. cm. Hg)}} = -1867.52/T - 0.015865T + 0.000015574T^2 + 12.07540$ . The entropy of SO<sub>2</sub> gas at the b.p., derived from calorimetric data, is 58.07 g.-cal. per degree per mol.;  $S_{298.1}^{\circ} = 59.23$ , in agreement with the val. calc. from available mol. data. The agreement shows that the entropy of SO<sub>2</sub> approaches 0 at 0° K. The linking angle of SO<sub>2</sub>, calc. from the entropy, is 129±4°. E. S. H.

**Heat of formation and specific heat of Ca<sub>3</sub>N<sub>2</sub>.** S. SATOH (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, 34, 534—595).—The sp. heat of Ca<sub>3</sub>N<sub>2</sub> determined by the ice calorimeter is given by  $C = 0.1817 + 1.273 \times 10^{-4}t + 1.388 \times 10^{-8}t^2$  after corrections have been made for the presence of Mg<sub>3</sub>N<sub>2</sub> and CaO as impurities. The heat of formation of Ca<sub>3</sub>N<sub>2</sub> was calc. from the dissociation pressure  $3\text{Ca} + \text{N}_2 = \text{Ca}_3\text{N}_2 + 108,200 \text{ g.-cal.}$

J. A. D.

**Heat of formation of zinc sulphide.** A. F. KAPUSTINSKI and I. A. KORSCHUNOV (J. Phys. Chem. Russ., 1938, 11, 220—227).—The heat of formation of wurtzite from sublimed Zn and rhombic S is 45.2 kg.-cal., and that of Zn blende is 48.4 kg.-cal.

J. J. B.

**Heat of formation of [iron and] cadmium sulphides.** A. F. KAPUSTINSKI and I. A. KORSCHUNOV (J. Phys. Chem. Russ., 1938, 11, 213—219).—FeS and CdS were prepared in a calorimeter from rhombic S and reduced Fe and sublimed Cd, respectively. The heats of formation were 22.3 and 34.5 kg.-cal. respectively.

J. J. B.

**Specific heat of carbon dioxide at low temperatures.** S. C. SIRKAR and J. GUPTA (Nature, 1938, 141, 915—916).—Comparison of observed vals. of  $C_p$  with calc. vals. for  $C_p$  at low temp. indicates that, besides the lattice oscillations, there is another which corresponds with the new Raman line (58 cm.<sup>-1</sup>) observed in CO<sub>2</sub> (A., 1938, I, 61) at low temp. This appears to take place in pairs of CO<sub>2</sub> mols., members of each pair being connected by a weak electronic bond.

L. S. T.

**Thermal data on organic compounds. XVIII. Heat capacity and entropy of *tert.*-butylethylene.** W. D. KENNEDY, C. H. SHOMATE, and G. S. PARKS (J. Amer. Chem. Soc., 1938, 60, 1507—1509).—Heat capacities have been determined at 80—298° K. The calc. mol. entropy at 298.1° K. is 61.3 g.-cal. per degree. A transition point between two cryst. forms occurs at 124.9° K.; the heat of transition is 12.35 and the heat of fusion 3.11 g.-cal. per g. The calc. free energy of dehydrogenation of ββ-dimethylbutane is 21,700±500 g.-cal.

E. S. H.

**Physico-chemical properties of the alkali metals.** M. LEMARCHANDS and L. ROUGEOT (Bull. Soc. chim., 1938, [v], 5, 901—910).—The m.p., b.p. at 760 mm. and at 1 mm., entropy change during evaporation, and mol. heats of sublimation of alkali metals can all be expressed by formulæ of the type  $x = a + b\gamma/\log_{10} Z$ , where  $a$  and  $b$  are consts. for each property,  $\gamma$  is the ratio of the sp. heats (1.667), and  $Z$  is the at. no. Results for Li are always anomalous, whilst some deviations are also observed for Na. Expressions for the heats of ionisation and heats of formation of the oxides are also discussed.

J. W. S.

**B.p. of benzene, ethylene chloride, *n*-heptane, and ββ-trimethylpentane over the range 660 to 860 mm. pressure.** E. R. SMITH and H. MATHESON (J. Res. Nat. Bur. Stand., 1938, 20, 641—650).—Data for the above liquids were obtained by the comparative ebulliometric method, using H<sub>2</sub>O as the reference standard. Equations for each liquid expressing the



relation between temp. and v.p. from 660 to 860 mm. are given. D. F. R.

**B.p. and chemical constitution. I. An additive function of mol. wt. and b.p.** V. C. E. BURNOP (J.C.S., 1938, 826—829).—Between the mol. wt. ( $M$ ) and the abs. b.p. ( $T$ ) there exists, for an homologous series of non-associating compounds, an additive empirical relation,  $M \log_{10} T + 8.0M^{\frac{1}{2}}$ . The vals. of this relation,  $b$ , are given for series of normal paraffins, olefines, diolefines, acetylenes, cycloparaffins, aromatic hydrocarbons, alkyl halides, ethers, esters, ketones, and amines. From these at. and structural contributions to  $b$  are derived. W. R. A.

**Stefan's law and non-linear electrodynamics.** B. KWAL and J. SOLOMON (J. Phys. Radium, 1938, [vii], 9, 205—208).—Mathematical. The consequences of abandoning the linearity of the equations of electrodynamics are considered for Stefan's law and for Wien's displacement law. W. R. A.

**Density differences at the critical point according to R. Plank's equation of state.** R. RUEDY (Canad. J. Res., 1938, 16, A, 89—99).—This equation leads to possible differences of 5% in densities measured at heights differing by 1 cm. in gases at the crit. point, and so large corrections are needed unless the material is agitated continually. Van der Waals' equation shows that the difference in level  $\Delta h \propto$  third power of the relative difference in density  $\Delta d = (d - d_c)/d_c$ ; Wohl's equation leads to  $\Delta h \propto (\Delta d)^4$ , and Plank's to  $\Delta h \propto (\Delta d)^5$ . T. H. G.

**Low vapour pressures of alkali halides.** J. E. MAYER and I. H. WINTNER (J. Chem. Physics, 1938, 6, 301—306).—V.p. over cryst. NaCl, KCl, RbCl, NaBr, KBr, and RbBr have been measured by Knudsen's method at approx. 900° K. and the heats of vaporisation evaluated. W. R. A.

**Experiments at low temperatures.** J. D. COCKCROFT (Nuovo Cim., 1938, 15, 35—40).—An account of thermal conductivity measurements of liquid He. O. J. W.

**Thermal expansion and conductivity in liquid helium II.** H. JONES (Proc. Phil. Camb. Soc., 1938, 34, 253—261).—The negative coeff. of thermal expansion of He II is a consequence of the disordering process taking place with rising temp. The thermal energy of He II is mainly energy of disorder. A theory of heat conduction, considered as a flow of disorder, is shown to be compatible with the experimental data at present available. F. J. L.

**Thermal conductivity of gaseous hydrocarbons and atomic polarisation.** R. DELAPLACE (Compt. rend., 1938, 206, 1646—1647).—Anomalies in the relative thermal conductivities in groups of isomeric hydrocarbons are shown to correspond with anomalies in the at. polarisation vals., confirming that the dynamic structure of the mol. is a factor affecting heat transfer between gas mols. and a surface. A. J. E. W.

**Coefficient of expansion of barium and calcium and allotropy.** P. G. CATH and O. L. VON STEENIS (Z. tech. Physik, 1936, 17, 239—241; Chem. Zentr., 1936, ii, 1845).—Between 0° and 300°, the coeff. of

linear expansion of Ba fluctuates between 170 and  $210 \times 10^{-7}$ , and is markedly dependent on previous thermal treatment. An arrest at 390° corresponds with the two different modifications. Ca behaves in a similar, but less marked, way. Below 300°, the coeff. is  $220 \times 10^{-7}$ . L. S. T.

**Thermal constants at high temperatures. II. Thermal expansion of rock-salt. III. Anomalous thermal expansion of bismuth, zinc, and cadmium near the m.p.** V. F. HASCHKOVSKI and P. G. STRELKOV. **IV. Coefficient of expansion of silver chloride and bromide.** P. G. STRELKOV (Physikal. Z. Sovietunion, 1937, 12, 35—44, 45—72, 73—82).—II. The thermal expansion coeff. of NaCl has been measured, using an interference method and also the quartz dilatometer (cf. A., 1938, I, 417). The total expansion from 0° K. to the m.p. is approx. 6%. An empirical formula for the variation of the coeff. with temp. is given.

III. Bi begins to show anomalous expansion at 40° below the m.p., Zn and Cd at approx. 10° below the m.p. The anomaly increases as the m.p. is reached and has the same sign as the vol. change on melting.

IV. The variation of the coeff. for AgCl and AgBr with temp. has been measured, and its relation to the electrical polarisation of the crystal is considered. The effect of small amounts of AgBr and NaCl on the temp. variation of the expansion coeff. of AgCl has also been examined. J. A. D.

**Thermal conductivity at low temperatures.** W. J. DE HAAS (Nature, 1938, 141, 1053; cf. A., 1938, I, 304).—The dependence of the heat-conductivity of quartz on crystal size has been determined at 2.5°, 2.9°, and 3.3° K. For SiO<sub>2</sub> and KCl the heat-resistance is a function of the radius. With increasing thickness, the sp. resistance approaches a const. val. asymptotically. It is assumed that resistance is due to scattering by the surface and by the mosaic structure, and to scattering of the elastic waves by one another. L. S. T.

**Viscosity of air and the electronic charge.** G. B. BANERJEA and B. PATTANAİK (Nature, 1938, 141, 1016—1017).—A redetermination gives for the  $\eta$  of dry air at 23° the val.  $(1833.3 \pm 2.1) \times 10^{-7}$  c.g.s. unit. The increase per °C. is  $4.95 \times 10^{-7}$  unit. Substitution of this val. of  $\eta$  in Millikan's data for the oil-drop experiment gives  $e = (4.811 \pm 0.009) \times 10^{-10}$  e.s.u. compared with the X-ray val. of  $4.807 \times 10^{-10}$ . L. S. T.

**Molecular force and viscosity of gases.** W. WEN-PO (Phil. Mag., 1938, [vii], 25, 865—883).—A theoretical treatment of mol. interaction, assuming spherical symmetry of the mols., leads to the equation  $\rho_l^{2/3} T^{1/2} / \eta M^{1/6} = \psi(LM/T)$ , where  $\rho_l$  is the density of the substance in the liquid state at its normal b.p.,  $\eta$  is the viscosity coeff.,  $L$  the latent heat of vaporisation, and  $\psi$  a common function for a group of related substances. Satisfactory agreement is obtained between calc. and observed vals. of  $\eta$  for He, Ne, A, Kr, Xe, Cl<sub>2</sub>, Br, I, H<sub>2</sub>, N<sub>2</sub>, and O<sub>2</sub>. H. J. E.

**Viscosity of air, oxygen, and nitrogen.** P. J. RIGDEN (Phil. Mag., 1938, [vii], 25, 961—981; cf.



A., 1938, I, 131).—The  $\eta$  of air at 17° is  $(1800.76 \pm 0.69) \times 10^{-7}$  c.g.s. [temp. coeff.  $(4.93 \pm 0.11) \times 10^{-7}$  per degree]. The val. for  $N_2$  at 17° is  $(1738.2 \pm 0.73) \times 10^{-7}$  c.g.s. (temp. coeff.  $4.76 \times 10^{-7}$  per degree) and that for  $O_2$  is  $(2010.5 \pm 0.9) \times 10^{-7}$  c.g.s. (temp. coeff.  $6.23 \times 10^{-7}$  per degree). H. J. E.

**Viscosity of mixtures of pyrrole with benzene, chlorobenzene, bromobenzene, and iodobenzene.** M. DEŽELIĆ (Bull. Soc. Chim. Yougoslav., 1937, 8, 139—143).—The composition- $d$  and  $-\eta$  curves have been determined, at 20°. Compounds are apparently not formed. R. T.

**Thermal properties of methyl chloride-mineral oil mixtures.** A. PERLICK (Z. ges. Kälte-Ind., 1936, 43, 32—35; Chem. Zentr., 1936, ii, 516).—The v.p. of the mixtures decreases with rising  $\eta$  of the mineral oil. H. N. R.

**Degree of depolarisation of scattered radiation from binary liquid mixtures.** R. KREMANN and E. GASTINGER (Monatsh., 1938, 71, 424—431).—The polarisation of light scattered by the mixtures  $C_6H_6$ -*n*-hexane,  $C_6H_6$ - $CHCl_3$ , and  $COMe_2$ - $CHCl_3$ , respectively, has been determined. The mol. constitution of the mixtures is discussed. E. S. H.

**Intermetallic compounds produced by next nearest neighbour interaction in alloys.** F. BITTER (J. Chem. Physics, 1938, 6, 339—340).—Theoretical. W. R. A.

**Order-disorder transformations in alloys.** F. C. NIX and W. SHOCKLEY (Rev. Mod. Physics, 1938, 10, 1—71).—A comprehensive review of published experimental and theoretical work. E. S. H.

**Suggested intermetallic reaction in a liquid antimony-copper-tin-lead alloy.** G. C. SEAGER and F. C. THOMPSON (Phil. Mag., 1938, [vii], 25, 1104—1107).—Measurements of rate of cooling and of variation of resistivity with temp. strongly support the conclusion that the abnormality observed by Ellis (B., 1925, 809) is due to the incidence of solidification and not to an intermetallic reaction. T. H. G.

**Critical solution temperatures of alcohols.** L. A. ZEPALOVA-MICHAILOVA (Sborn. Rabot Lab. Inst., 1937, 15, 3—19).—Data are recorded for the systems (a) EtOH-diisooctyl, (b) Pr<sup>o</sup>OH-vaseline oil, and (c) Pr<sup>o</sup>OH-vaseline oil. The effects of adding traces of H<sub>2</sub>O to each system and of EtOH to (b) and (c) are shown. H<sub>2</sub>O raises the crit. solution temp. of both Pr<sup>o</sup>OH and Pr<sup>o</sup>OH considerably whilst EtOH has little effect. D. G.

**Separation of phases in the water-phenol-isobutyl alcohol system.** M. F. TALINA and I. A. MALAFEEV (J. Phys. Chem. Russ., 1938, 11, 270—273).—Equilibrium data at 40° and 70° are recorded and discussed. J. J. B.

**Pressure of saturated vapour.** J. K. SIRKIN (J. Phys. Chem. Russ., 1938, 11, 161—168).—The van der Waals equation for v.p. can be given the form  $\log p = \log p_c + L/4.57T_c - L/4.57T$ . An analogous expression is deduced for the v.p. over solid bodies. Both formulae are in agreement with experimental data. J. J. B.

**Solubilities of polythionates. II. Solubilities of sodium and ammonium polythionates.** A. KURTENACKER and G. LÁSZLÓ (Z. anorg. Chem., 1938, 237, 359—368).— $NH_4$  pentathionate,  $(NH_4)_2S_5O_{11} \cdot 5H_2O$ , has been prepared. The solubilities of Na and  $NH_4$  tri- and tetra-thionates have been measured at 0°, 20°, and 30°, and the 0° and 20° isotherms of the systems  $Na_2S_3O_6$ - $Na_2S_4O_6$ -H<sub>2</sub>O,  $Na_2S_4O_6$ - $Na_2S_5O_{11}$ -H<sub>2</sub>O, and  $(NH_4)_2S_3O_6$ - $(NH_4)_2S_4O_6$ -H<sub>2</sub>O have been determined. The only solid phases are the single salts. The  $NH_4$  salts are anhyd.; Na tetra- and penta-thionates are present as dihydrates;  $Na_2S_3O_6$  is present as trihydrate at 0° but the solid phase contains less H<sub>2</sub>O at 20° and the transition point  $3H_2O \rightarrow$  anhyd. is probably at or near this temp. F. J. G.

**Solubility of iodine pentoxide in anhydrous hydrogen fluoride and the possible existence of "hydrofluorates" of iodine pentoxide.** K. R. WEBB (Proc. Leeds Phil. Soc., 1938, 3, 477—480).—Experiments under various conditions, afford evidence of the solubility of  $I_2O_5$  in anhyd. HF, and the probable formation of unstable compounds of the type  $I_2O_5 \cdot xHF$  by the spontaneous evaporation of such solutions at room temp. N. M. B.

**Solubility of gold hydroxide in alkali and equilibria in the saturated solutions.** H. L. JOHNSTON and H. L. LELAND (J. Amer. Chem. Soc., 1938, 60, 1439—1445).—Data are recorded for 0—8*N*-NaOH. The solubility of  $Au(OH)_3$  increases with increasing [NaOH] up to 0.42*N*, then falls rapidly to a min. at *N*-NaOH, and rises almost linearly as [NaOH] is further increased. The stable solid phase is  $Au(OH)_3$  below 0.42*N*-NaOH, and  $Na_2HAuO_3$  above 0.42*N*-NaOH. The ionic equilibria are discussed, and acid dissociation consts. for  $H_2AuO_3$  are derived and compared with those for Cu and Ag hydroxides. A potentiometric method for the determination of Au is described. E. S. H.

**Aqueous solubilities of isomeric hexanols.** P. M. GINNINGS and R. WEBB (J. Amer. Chem. Soc., 1938, 60, 1388—1389).—Data for methyl-diethyl-, dimethyl-isopropyl-, dimethyl-*n*-propyl-, methyl-*tert*-butyl-, ethyl-isopropyl-, methyl-*sec*-butyl-, methyl-isobutyl-, ethyl-*n*-propyl-, methyl-*n*-butyl-, and *tert*-amyl-carbinol at 20°, 25°, and 30° are recorded. The *tert*. isomerides are more sol. than the *sec*., which are in turn more sol. than the most compact primary isomeride. Solubility is greatest when OH is in proximity to the centre of a compact mol., and decreases in each case with rise of temp. E. S. H.

**Hydrogen bonds involving the C-H linking. Solubility of haloforms in donor solvents.** G. F. ZELLHOEFER, M. J. COPLEY, and C. S. MARVEL (J. Amer. Chem. Soc., 1938, 60, 1337—1343).—The solubilities of MeCl,  $CH_2Cl_2$ ,  $CHCl_3$ ,  $CH_2ClF$ ,  $CHCl_2F$ ,  $CHClF_2$ , EtCl,  $CCl_2F$ ,  $CCl_2F_2$ ,  $C_2Cl_3F_3$ , and  $C_2Cl_2F_4$  each in  $OEt \cdot [CH_2]_2 \cdot O \cdot [CH_2]_2 \cdot OAc$ ,  $(OMe \cdot [CH_2]_2 \cdot O \cdot [CH_2]_2 \cdot O)_2$ , and  $(OEt \cdot [CH_2]_2 \cdot O)_2$ , and of  $CHCl_2F$  in 82 solvents (ethers, thioethers, esters, ether-esters, CO-compounds, bases, amides, hydrocarbons, fluorohydrocarbons, and  $PhNO_2$ ) have been determined. The observed vals. exceed the "ideal"



solubility if the solute contains H and the solvent O (ether or ester) or basic N. The effect is in the order:  $\text{CH}_3 < \text{CH}_2 < \text{CH}$ , being greatest for  $\text{CHCl}_3$ . H bonds,  $\text{O} \rightarrow \text{H}$  and  $\text{N} \rightarrow \text{H}$ , are postulated in the interpretation of the results. R. S. C.

**Unlimited solubility of metals in the solid state.** N. AGEEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, 19, 65—68).—The view that a given crystal structure is possible only if the electrons are able to arrange themselves in accordance with a definite energy distribution has been applied to a face-centred cube, and the conditions for the formation of a continuous series of solid solutions have been examined. N. M. B.

**General problem in the theory of diffusion.** B. HOSTINSKÝ (Compt. rend., 1938, 206, 1452—1455).—Theoretical. A. J. E. W.

**Diffusion of gold into gold.** A. ZAGRUBSKI (Physikal. Z. Sovietunion, 1937, 12, 118—119).—Radioactive Au, obtained by neutron bombardment, was placed in intimate contact with an ordinary Au sheet. The rate of diffusion was estimated by etching away the surface layers of the sheet and then measuring the radioactive residue. J. A. D.

**Coefficient of self-diffusion of gold.** A. M. ZAGRUBSKI (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1937, 903—913; cf. A., 1933, 561; 1937, I, 296).—Geiger counter measurements of the penetration of its radioactive isotope from a Au plate into electrolytically deposited Au layers give vals. at 800—1020° which can be represented by  $D = 1.36 \times 10^4 e^{-53000/RT}$ . The results accord with the formulae of Langmuir and of Braune. I. MCA.

**Adsorption of gases by graphite.** A. B. LAMB and E. N. OHL (J. Amer. Chem. Soc., 1938, 60, 1287—1290).—Measurements of the adsorption of  $\text{CO}_2$ ,  $\text{H}_2$ , and  $\text{CCl}_2\text{F}_2$  on graphite and on activated C show that the adsorbed gas mols. do not enter the spaces between the basal planes of the graphite crystal, but are held at the external surface. The adsorption of  $\text{H}_2$ , He, and  $\text{CS}_2$  by C produced by "explosion" of graphitic oxide has also been measured; although relatively large amounts are adsorbed, adsorption occurs only at the external surface. X-Ray diagrams show that the graphite structure is retained by this C, but that the average particle size is about 30 Å, giving a greatly increased surface. Graphite obtained by heating SiC until the Si has evaporated shows poor adsorptive capacity. E. S. H.

**Sorption of chlorine by activated charcoal.** L. H. REYERSON and A. W. WISHART (J. Physical Chem., 1938, 42, 679—685).—Adsorption isotherms of  $\text{Cl}_2$  on steam-activated charcoal have been obtained at 35.5°, 51.0°, 73.5°, and 91.5°. The adsorption is about the same as that of Br (A., 1935, 696) but about 10 times that of I. The characteristics of the adsorption are very different from that on  $\text{SiO}_2$  gel (A., 1937, I, 611). The min. surface area of the charcoal is  $5.54 \times 10^6 \text{ cm}^2 \text{ per g}$ . J. W. S.

**Theory of adsorption of vapours.** S. J. PSCHESHEZKI (J. Phys. Chem. Russ., 1938, 11, 205—212).—The adsorption isotherm of vapours is said to

consist of two parts corresponding with the equations  $a = bp^m$  and  $a = C + B \log p$ , respectively;  $b$ ,  $m$ ,  $C$ , and  $B$  are const. The temp. variation of these const. is calc. on the assumption of the invariability of the adsorption potential with the temp. J. J. B.

**Determination of nature of binding in adsorption media.** R. JUZA, R. LANGHEIM, and H. HAHN (Angew. Chem., 1938, 51, 354—357).—Adsorption in the systems C—Br,  $\text{SiO}_2$ —Br, and C— $\text{O}_2$  has been studied by means of magnetic susceptibility measurements. The susceptibility of the adsorbed system is not an additive function of those of the components. The deviation from additivity decreases as successive amounts are adsorbed, indicating that the binding is weaker in the successive layers. E. S. H.

**Adsorption of aliphatic amines and products of protein fission on aluminium oxide from aqueous solution.** A. LOTTERMOSER and K. EDELMANN (Kolloid-Z., 1938, 83, 262—278).—To serve as a basis for the possible separation of the hydrolysis products of proteins by chromatographic analysis, the adsorption isotherms of the most important of such products and of simpler related substances ( $\text{NH}_3$ ,  $\text{NH}_4$  salts, mono- and di-amines) have been determined. The best adsorbent is  $\text{Al}_2\text{O}_3$  prepared by Brockmann's method.  $\text{NH}_3$  is better adsorbed at low than at high  $p_{\text{H}}$ , and the adsorption of  $\text{NH}_4$  salts is scarcely influenced by the valency of the anion. The hydrochlorides of primary, *sec.*, and *tert.* amines are adsorbed similarly, the adsorption increasing with the mol. wt. without being influenced by branching of the C chain. The homologous aminomonocarboxylic acids give normal isotherms, but the adsorbability decreases with increasing mol. wt. Among the dicarboxylic acids lysine dihydrochloride, tyrosine, and 3 : 5-di-iodotyrosine are not adsorbed at all and can thus be separated from all other products. The order of adsorption of the heterocyclic  $\text{NH}_2$ -acids is histidine > tryptophan > oxyproline > proline. F. L. U.

**Surface tension of fused mixtures with a cryolite base.** É. ELCHARDUS (Compt. rend., 1938, 206, 1460—1462).—Vals. of  $\gamma$  for mixtures of cryolite, NaF or  $\text{AlF}_3$ , and  $\text{Al}_2\text{O}_3$  are recorded.  $\gamma$  is decreased by addition of  $\text{AlF}_3$ , and increased by NaF;  $\text{Al}_2\text{O}_3$  has a variable effect. In the neighbourhood of the m.p.  $\gamma$  increases with temp. owing to ionic dissociation, the  $\gamma$ - $\theta$  curves having the form required by theory (Onsager and Samaras, A., 1934, 1068).

**Measurement of superficial electric moment in the interior of a liquid.** (MLLE.) N. CHOUCROUN and M. ARDITI (Compt. rend., 1938, 206, 1462—1464; cf. A., 1934, 1068).—A micro-electrophoresis apparatus for the observation of particles 1—2 mm. below the surface of the suspending liquid is described. Vals. of the superficial electric moment of particles of mastic and gamboge suspended in  $\text{H}_2\text{O}$  and 0.002N-HCl and -NaOH, and of the walls of the Pyrex and flint glass containing tubes, are recorded. The moments of the particles and tube walls are independent of each other. The surfaces are negatively charged in each case, the potential increasing with  $p_{\text{H}}$ . A. J. E. W.



**Capillary systems. XIX (8). Permeability of coherent and compact material for gaseous and dissolved substances.** E. MANEGOLD (Kolloid-Z., 1938, 83, 299—319; cf. A., 1938, I, 355).—Data relating to liquid-liquid and liquid-gas interfaces and to plant cells are collected. F. L. U.

**Theory of electrocapillarity. VII. Theory of surface films.** S. R. CRAXFORD, O. GATTY, and T. TEORELL (Phil. Mag., 1938, [vii], 25, 1041—1061).—Equations previously deduced (A., 1935, 698; 1936, 1196) are extended to surface films and applied to a typical and a simplified case, but existing data are insufficient to permit the use of precise equations. Boundary conditions are considered in relation to available data. The theory of two coexistent surface phases is discussed. A factor which contributes to the high capacities of specifically adsorbed anions is suggested. Measurements of surface tension and chemical potential alone are insufficient to indicate the degree of dissociation of a compound in an interphase or surface film. T. H. G.

**Viscosity of unimolecular films.** D. G. DERVICHIAN and M. JOLY (Nature, 1938, 141, 975; cf. A., 1937, I, 358).—The flow of surface monolayers  $\propto$  the difference of pressure and inversely  $\propto$  the length of the channel, but the dependence of flow on the width of the slit is complicated by entrainment of  $H_2O$ . L. S. T.

**Pressure-area relations of monolayers at the solid-liquid interface.** W. D. HARKINS and F. M. FOWKES (J. Amer. Chem. Soc., 1938, 60, 1511—1512).—Pressure-area curves for monolayers of BuOH at  $H_2O$ -air,  $H_2O$ -solid paraffin, and  $H_2O$ -stibnite interfaces, and for AcOH at a  $H_2O$ -solid paraffin interface, show that the films are gaseous at low pressures. E. S. H.

**Flow of unimolecular surface films.** E. R. WASHBURN and H. R. R. WAKEHAM (J. Amer. Chem. Soc., 1938, 60, 1294—1296).—The area of a unimol. stearic acid film which flows through a capillary increases with increasing applied film pressure, but the relation is not linear. For equal pressures, films on acid solutions flow more rapidly than films on neutral solutions. For equal pressures and  $[H^+]$ , films flow more rapidly at higher than at lower temp.; the temp. coeff. is greater at low than at high pressures. E. S. H.

**Effect of X-rays on surface potentials of multilayers.** F. J. NORTON and I. LANGMUIR (J. Amer. Chem. Soc., 1938, 60, 1513).—The charging of X and Y multilayers of stearates by exposure to X-rays is described. E. S. H.

**Activities of urease and pepsin monolayers.** I. LANGMUIR and V. J. SCHAEFER (J. Amer. Chem. Soc., 1938, 60, 1351—1360).—The monolayers, spread on  $H_2O$  and then deposited on plates, or adsorbed from solution by conditioned plates, usually have high chemical activity. The activity of a urease layer, measured by the formation of  $NH_3$  from  $CO(NH_2)_2$  at  $p_H$  7, disappears when deposited as an A layer on a surface conditioned with Na deoxycholate. Thus, the activity depends on the presence of hydrophobic groups in the surface. The activity of pepsin was

tested by its power to clot skimmed milk. A substance in milk displaces adsorbed pepsin monolayers on the plate and allows the pepsin to diffuse into the solution in a completely active form. In many cases the sp. activity of the pepsin monolayers prepared from commercial pepsin was  $\ll$  that of the original pepsin. E. S. H.

**Investigation of thin layers of organic substances at the mercury/solution boundary by capacity measurements. I. High-molecular alcohols and acids.** A. GORODETZKAJA and A. FRUMKIN (Compt. rend. Acad. Sci. U.R.S.S., 1938, 18, 639—643; cf. A., 1935, 298, 697; 1936, 1467).—With and without uni- and multi-mol. layers of cetyl alcohol (I), palmitic (II) and oleic acids (III), at the Hg/slightly acid  $N-Na_2SO_4$  interface, measured vals. for the capacity of the electrical double layer are plotted against cathodic polarisation. For (I), a single const. min. capacity 1.03, decreasing on compression to 0.91  $\mu F.$  per sq. cm., indicates a layer thickness  $d$  of 19  $\text{Å}$ . (the length of the mol.), using the formula  $C = \epsilon/4\pi d$  for a surface condenser. For (II) and (III) two min. capacities are indicated; these decrease on compression as a result of the formation of unstable multilayers the nature of which has been corroborated in the case of (III) by interference methods. Calculation of  $d$  from capacities is unreliable for multi- (>3 mono-)layers owing to ionic penetration. I. McA.

**Transition state in surface reactions. M. TEMKIN (J. Phys. Chem. Russ., 1938, 11, 169—189).**—A theory is advanced to explain the rates of gas adsorption and of heterogeneous reactions. The differences between this theory and that based on collision frequencies are pointed out. The views expressed are considered to afford a plausible interpretation of false equilibria. J. J. B.

**Surface  $p_H$ .** S. R. CRAXFORD, O. GATTY, and T. TEORELL (Phil. Mag., 1938, [vii], 25, 1061—1066).—The usual definition of  $p_H$  is unsatisfactory when applied to interphases and surface films and two others are discussed, although measurements in terms of these are not directly possible. The consequences of these conclusions for many physico-chemical and biological questions are very important. T. H. G.

**Electrokinetic potential. II. Electrokinetic potential at the interfaces glass/ethyl alcohol-water and glass/acetone-water.** K. KANAMARU, T. TAKADA, and K. AIKAWA (Kolloid-Z., 1938, 83, 294—299).—These mixtures behave similarly to the dioxan- $H_2O$  mixtures, in that the  $\zeta$ -potential against glass is determined by the mol.-polarisation rather than by the difference of  $\epsilon$  values. The  $\zeta$ -potential can be expressed empirically by the formula  $10^m(\epsilon - \epsilon_g)P^n$ , where  $\epsilon$  and  $\epsilon_g$  refer to the liquid mixture and the glass respectively,  $P$  is the mol. polarisation of the mixture, and  $m$  and  $n$  are consts. which have nearly the same val. for all the systems studied. F. L. U.

**Electrokinetics. XX. Interfacial energy and the molecular structure of organic compounds. VI. Electric moment of aliphatic alcohols, acids, and esters at cellulose and aluminium**



**oxide interfaces.** M. A. LAUFFER and R. A. GORTNER (*J. Physical Chem.*, 1938, **42**, 641—656; cf. *A.*, 1933, 122).—The electric moment ( $\mu$ ) per sq. cm. of the double layer has been determined by the streaming potential method for aliphatic alcohols containing 1—7 C atoms at  $\text{Al}_2\text{O}_3$  surfaces, and for fatty acids and esters at cellulose surfaces. In all cases the streaming potential  $\propto$  pressure. The vals. of  $\mu$  for alcohols on  $\text{Al}_2\text{O}_3$  are about half as large as those on cellulose. Reversal of the sign of  $\mu$  occurs between  $\text{Bu}^\circ\text{OH}$  and  $n\text{-C}_5\text{H}_{11}\text{-OH}$  at  $\text{Al}_2\text{O}_3$  surfaces, and between  $\text{EtOH}$  and  $\text{Pr}^\circ\text{OH}$  at cellulose surfaces. In each case  $\text{Pr}^\circ\text{OH}$  is opposite in sign to  $\text{Pr}^\circ\text{OH}$ . Fatty acids at cellulose surfaces show reversal of sign between  $\text{EtCO}_2\text{H}$  and  $\text{Pr}^\circ\text{CO}_2\text{H}$ , but no reversal is shown on  $\text{Al}_2\text{O}_3$ . The vals. of  $\mu$  are about one third of those on  $\text{Al}_2\text{O}_3$ . The variation with temp. of the conductivity and electrokinetic function of  $\text{MeOAc}$  in the diaphragm suggests that the effects observed are due to interaction of ions derived from the org. mols. of the liquids and the solid with which it is in contact. J. W. S.

**Transfer of helium II on glass.** J. G. DAUNT and K. MENDELSSOHN (*Nature*, 1938, **141**, 911—912).—Experiments with various arrangements of vessels indicate that the surface of a solid in contact with liquid He II is covered with a He film through which the liquid is transferred to the lowest available level; the rate of transfer increases rapidly with a fall in temp., and on glass is  $>$  on Cu. L. S. T.

**Experiments with liquid helium II.** A. K. KIKOIN and B. G. LASAREW (*Nature*, 1938, **141**, 912—913).—When a vac.-insulated glass tube, which can be heated electrically at the upper end, is partly immersed in liquid He II no heating effect becomes apparent in the upper part of the tube until a limiting current is reached. A film of liquid He II appears to be formed over the surface of the tube and heating begins only when this film evaporates at the limiting val. of the current. The calc. thickness of the film is  $\sim 10^{-5}$  cm. L. S. T.

**Transport phenomena in helium II.** L. TISZA (*Nature*, 1938, **141**, 913).—An interpretation of the behaviour of He II on the assumption that its viscosity is due to the atoms in the "excited" state is discussed. A temp. gradient should arise during the flow of He II through a capillary. L. S. T.

**Adhesion of particles of microscopic size.** VIII. **Adhesion of calcium carbonate particles in electrolyte solutions.** A. VON BUZÁGH and K. DUX (*Kolloid-Z.*, 1938, **83**, 279—287; cf. *A.*, 1938, I, 358).— $\text{CaCO}_3$  particles behave similarly to those of  $\text{BaSO}_4$  with respect to the influence of electrolytes on adhesion and on electrophoretic mobility.  $\text{LiCl}$ ,  $\text{NaCl}$ , and  $\text{KCl}$  increase adhesion towards a const. val., and reduce but do not reverse the electrokinetic charge. Bi- and ter-valent cations at higher concns. reverse the charge and diminish adhesion. Specially marked effects are shown by  $\text{Ca}^{++}$ ,  $\text{CO}_3^{--}$ ,  $\text{HCO}_3^-$ , and  $\text{OH}'$ . F. L. U.

**Influence of inorganic salts on the rotation of sucrose solutions.** E. LANDT (*Deut. Zuckerind.*, 1936, **61**, 377—378; *Chem. Zentr.*, 1936, ii, 1888).—

A primary dehydration effect with electrostatic deformation and complex formation is postulated.

A. H. C.

**Determination of crystallite size in metal and metal oxide smokes from X-ray and electron diffraction digrams and from electron microscope pictures.** D. BEISCHER (*Z. Elektrochem.*, 1938, **44**, 375—385).—The available methods are described, illustrated, and compared. The electron diffraction method is applicable only to particles  $< 100$  Å. In the smokes examined no particles  $< 10$  Å. were observed, and any particles of this size originally formed must increase rapidly either by aggregation or by the addition of metal atoms from the vapour phase. C. R. H.

**Trajectory of ash particles in air and the determination of their size.** K. PROSAD and D. N. SEN (*Phil. Mag.*, 1938, [vii], **25**, 993—1003).—Photographs of the trajectory of a beam of cigar ash particles projected horizontally in air are used in determining the mean particle size (radius =  $2.34 \times 10^{-3}$  cm.). The particle size is shown to increase rapidly along the path. H. J. E.

**Relationship between degree of depolarisation and particle properties in the scattering of light by colloids.** W. LOTMAR (*Helv. Chim. Acta*, 1938, **21**, 792—812).—Mathematical. The influence of the size, shape, and concn. of particles on the degree of depolarisation of light scattered by colloidal solutions is discussed. J. W. S.

**Electrochemical properties of mastic suspensions.** R. AUDUBERT and G. CARPÉNI (*J. Chim. phys.*, 1938, **35**, 115—128).—Aq. and alcoholic sols of mastic of varying particle size have been potentiometrically titrated using a glass electrode, and the data compared with data similarly obtained for the ultrafiltered sols. Differences are ascribed to acids on the surface of the mastic particles. In the case of small particles of diameter  $< 1 \mu$ . the electric charge can be ascribed principally to surface ionisation phenomena, but with increasing particle size the influence of surface ionisation diminishes. The data are discussed in reference to the electrochemical structure of the particle surface. C. R. H.

**Titanium oxide hydrosols. Some relationships to oxide hydrosols of zirconium and thorium.** H. S. OWENS and R. MORRIS (*J. Physical Chem.*, 1938, **42**, 563—566; cf. *A.*, 1935, 1459).—The  $p_{\text{H}}$  of  $\text{TiO}_2$  hydrosols is raised by heating or by addition of K salts, the order of efficiency of which is  $\text{C}_2\text{O}_4^{--} > \text{tartrate} > \text{SO}_4^{--} > \text{Cl}'$ . From the behaviour observed it is inferred that the sols are composed mainly of  $\text{TiO}_2$  with few hydroxo or ol groups. The reaction with tartrate to form negatively charged micelles is attributed to chelation. J. W. S.

**Electron microscope in colloid chemistry.** D. BEISCHER and F. KRAUSE (*Angew. Chem.*, 1938, **51**, 331—335; cf. *A.*, 1938, I, 78).—Further examples of the application of the electron microscope to the study of colloidal systems are given. The systems described include  $\text{ZnO}$ ,  $\text{CdO}$ , and lampblack, and membranes of colloidal Au in gelatin, collodion,  $\text{V}_2\text{O}_5$ , and rubber.

F. L. U.



**New results and problems in colloid investigation.** P. A. THIESSEN (*Angew. Chem.*, 1938, 51, 318—324).—A review. F. L. U.

**Dielectric behaviour of water in hydroxides, basic hydrates, and oxides of iron, beryllium, and magnesium.** O. GLEMSER (*Z. Elektrochem.*, 1938, 44, 341—353).—The dependence on temp. of the dielectric const.,  $\epsilon$ , of suspensions in paraffin oil has been investigated. As expected, for compounds containing combined  $H_2O$ ,  $\epsilon$  increases linearly with decrease in temp., no discontinuity being observed at  $0^\circ$ . For hydrated  $Fe_2O_3$  gels of various ages,  $\epsilon$  decreases with decrease in temp., but the absence of discontinuity indicates that the  $H_2O$  is not simply adsorbed.  $H_2O$  is considered to be retained in capillaries of such small dimensions that its v.p. and, therefore, f.p. are reduced. No discontinuity was detected above  $-60^\circ$ . C. R. H.

**Gel water in skeleton structures and macro-crystals.** D. BALAREV (*Kolloid-Z.*, 1938, 83, 319—321; cf. A., 1935, 447).—The v.p. of  $H_2O$  emmeshed in pptd.  $BaSO_4$  and in  $NH_4Cl$  crystallised from solutions containing  $CoCl_2$  and  $FeCl_3$  has been measured during dehydration and rehydration. Curves are obtained resembling those given by typical gels. The results are interpreted in the light of the author's theory. F. L. U.

**Silica jellies. I. Gelation time and change in  $p_H$  value as functions of concentration, initial  $p_H$  value, and temperature.** H. W. BATCHELOR (*J. Physical Chem.*, 1938, 42, 575—585).—The times of gelation and  $p_H$  changes during gelation observed are expressed in three-dimensional diagrams. With decreasing temp. min. gelation times at const. concn. are found to be associated with the progressively higher  $p_H$  vals. J. W. S.

**De-emulsification.** E. NAGELSTEIN (*Kolloid-Z.*, 1938, 83, 324).—The presence of air entrapped in emulsions contributes markedly to their instability. This factor is of greater importance than the dissolution of alkali from the glass container, suggested by Cheesman and King (A., 1938, I, 310). F. L. U.

**Comparative study of transparency and particle number in the coagulation of  $As_2S_3$  sols.** K. HOFFMANN and H. A. WANNOW (*Kolloid-Z.*, 1938, 83, 258—262; cf. A., 1937, I, 564).—During coagulation of  $As_2S_3$  sols by  $KCl$ ,  $MgCl_2$ , and  $LaCl_3$ , the transparency to light and the particle concn. decrease in such a manner that similar curves are obtained when these two quantities are plotted against the activity coeff. of the added cation. Divergence occurs in the later stages owing to differences in the structure of the aggregates, which with  $KCl$  are large and loosely packed and with  $LaCl_3$  small and compact. Approx. agreement with Rayleigh's theory is found only in the early stages when the particles are small. F. L. U.

**Protective action and sensitisation.** H. R. KRUYT and C. W. HORSTING (*Rec. trav. chim.*, 1938, 57, 737—740).—At low concns. Na arabate (I) (from gum arabic and  $NaOAc$ ) and starch sensitise  $AgI$  sols, whilst at higher concns. they exert a protective

action. Changes in flocculation vals. for  $KNO_3$ ,  $Ba(NO_3)_2$ , and  $Ce(NO_3)_2$  after addition of (I) are discussed. The nature of the flocculation process is considered. W. R. A.

**Mechanism of the development of the isoelectric zone in gelatin gels submitted to electrolysis. II.** J. SWYNGEDAuw (*Compt. rend. Soc. Biol.*, 1938, 128, 199—202; cf. A., 1938, III, 234).—The development of the isoelectric zone is due to the prevention of infiltration of the products of electrolysis by a process of electrofiltration, whilst a  $[H^+]$  of  $10^{-4.7}$  allows the passage of current through a zone freed from ions combined with the gelatin. H. G. R.

**Flow potentials, electro-osmosis, and electro-phoresis with platinum.** H. R. KRUYT and J. OOSTERMAN (*Proc. K. Akad. Wetensch. Amsterdam*, 1938, 41, 370—374).—No electro-osmotic transfer is observed when a p.d. of 180 v. is applied across a porous plug of Pt-black or Pt-sponge. These and similar negative results with flow potentials (A., 1937, I, 415) are contrasted with the electrophoretic transfer of particles in Pt sols (Bredig). Consideration of the disposition of the lines of electric force provides a satisfactory explanation in all three cases. Pt sols in  $10^{-4}N$ -HCl are unstable and exhibit a low mobility which, however, is increased, and the sols are rendered stable, by the addition of 0.1% of quinhydrone. F. L. U.

**Migration of adrenaline in an electrical field.** G. SANKARAN and S. RANGANATHAN (*Indian J. med. Res.*, 1937, 25, 81—83).—The migration of adrenaline was studied after exposure to a const. electric field for 24 hr. in buffer solutions of  $p_H$  1.15—12.4. Adrenaline migrated to the electro-negative pole in acid or slightly alkaline, and to the electro-positive in strongly alkaline, solutions. H. B. C.

**Physical chemistry of the proteins. XIV. Solvent action of sodium chloride on carboxy-haemoglobin in 25 and 35% ethyl alcohol at  $-5^\circ$ .** R. M. FERRY, E. J. COHN, and E. S. NEWMAN (*J. Amer. Chem. Soc.*, 1938, 60, 1480—1486; cf. A., 1937, I, 134).—The solubility of horse carboxyhaemoglobin in  $EtOH-H_2O$  containing  $NaCl$  at ionic strengths 0.01—0.2 has been determined. Activity coeffs. have been derived from the solubility ratios and compared with vals. calc. on the basis of Kirkwood's theory, assuming haemoglobin to be a double dipole with a moment of  $500 \times 10^{-18}$  e.s.u. Effects due to electric moments of higher order and to salting-out have also been considered. E. S. H.

**Variations in electric charge of proteins submitted to the action of proteolytic enzymes. II. Pepsin. III.** J. LOISELEUR (*Ann. Ferm.*, 1938, 4, 220—241).—Addition of pepsin to a protein solution causes an immediate fall in  $\zeta$ -potential, due to fixation of pepsin on dissociated protein groups. The fall is never complete, some groups remaining free, but the rapidity of hydrolysis is determined by the extent of the fall. With rapid hydrolysis  $\zeta$  quickly returns to its initial val., but with slow hydrolysis the initial val. is reached only after a considerable interval. It thus appears that fixation precedes hydrolysis, and that stabilisation of  $\zeta$  in the course of the reaction



represents an equilibrium between fixation of protein groups and the liberation of new dissociated groups. I. A. P.

**Presentation of the fundamentals of thermodynamics.** W. E. ROSEVEARE (J. Chem. Educ., 1938, 15, 214—217). L. S. T.

**Temperature variation of diffusion processes.** H. S. TAYLOR (J. Chem. Physics, 1938, 6, 331—334).—Eyring's concept of holes in liquids and his theory of abs. reaction rates, which suggest that diffusion coeffs. should vary exponentially with temp., are borne out by existing data. Liquids containing H bonds have high activation energies of diffusion. The conclusion that small diffusing mols. should not show a const. diffusion-viscosity product appears to be confirmed. W. R. A.

**Free energy and entropy of nitrosyl chloride.** F. P. JAHN (J. Chem. Physics, 1938, 6, 335—338).—From electron diffraction and mol. spectral data the experimental measurements of the NOCl dissociation equilibrium may be checked. Vals. of the free energy function,  $(G^\circ - U_0^\circ)/T$ , and the entropy,  $S^\circ$ , are calc. for the ideal gas from 298.1° to 1000° K. at 50° intervals. The electronic wt. is 4 and by comparison with equilibrium data for  $2\text{NOCl} \rightleftharpoons 2\text{NO} + \text{Cl}_2$   $\Delta U_0^\circ$  is  $15,510 \pm 53$  g.-cal. From this the equilibrium consts. for the reaction at 50° intervals between 450° and 750° are computed and compared with recorded experimental vals. W. R. A.

**Thermodynamic functions of the chloro- and bromo-methanes, formaldehyde, and phosgene.** D. P. STEVENSON and J. Y. BEACH (J. Chem. Physics, 1938, 6, 341).—Errata (cf. A., 1938, I, 185). W. R. A.

**Water-gas equilibrium.** G. MEYER and F. E. C. SCHEFFER (Rec. trav. chim., 1938, 57, 604—608).—Using an apparatus previously described (A., 1935, 583) the equilibrium  $\text{CO}_2 + \text{H}_2 \rightleftharpoons \text{CO} + \text{H}_2\text{O}$  has been investigated. The vals. of the equilibrium const. agree with those previously derived indirectly from the reactions  $\text{Sn} + 2\text{H}_2\text{O} \rightleftharpoons \text{SnO}_2 + 2\text{H}_2$  and  $\text{Sn} + 2\text{CO}_2 \rightleftharpoons \text{SnO}_2 + 2\text{CO}$ . W. R. A.

**Present status of the thermodynamics of electrolytic solutions.** H. S. HARNED (J. Franklin Inst., 1938, 225, 623—659).—A lecture. Activity coeffs. of strong electrolytes, calc. from e.m.f., f.p., b.p., and v.p. measurements, relative partial molal heat contents deduced from heats of dilution and e.m.f. data, and relative partial molal heat capacities, deduced from calorimetric and e.m.f. data, are compared. The ionic activity product of  $\text{H}_2\text{O}$  and the energy relations in the combination of  $\text{H}^\cdot$  and  $\text{OH}^\cdot$  under various conditions and as deduced by various methods are discussed. The thermodynamics of solutions of electrolytes in a mixture of  $\text{H}_2\text{O}$  and other solvents, and the extrapolation of activity coeffs. to saturated solutions, are also considered. J. W. S.

**Development of a theory of solutions (binary systems) on the basis of solution forces, and the test of the results against experiment.** K. FREDENHAGEN (Z. physikal. Chem., 1938, B, 40, 51—107).—The limitations of the van 't Hoff and Planck methods of dealing with the problem of the v.p. of

binary mixtures are reviewed. A general theory is developed which envisages the possibility of reaction between the two components with formation of a compound. Various binary systems of inorg. and org. compounds, and binary metallic systems, in which compound formation may occur, are discussed. H. J. E.

**Solubility and activity coefficients of barium *p*-iodobenzenesulphonate in solutions of strong electrolytes.** J. ŠIRUCEK (J. Chim. phys., 1938, 35, 136—142).—The solubility at 20° has been determined in  $\text{H}_2\text{O}$  and in solutions of  $\text{KNO}_3$ ,  $\text{KCl}$ ,  $\text{MgCl}_2$ , and  $\text{LaCl}_3$ . 100 g. of  $\text{H}_2\text{O}$  dissolve 0.8589 g. of the salt and in presence of electrolyte the solubility increases with increasing electrolyte concn. Activity coeffs. have been calc. by two methods, with concordant results. The mean val. for the radius of the sphere of influence of the ions is 4—6 Å. C. R. H.

**F.p. of concentrated aqueous solutions of urea, urethane, and acetamide.** H. M. CHADWELL and F. W. POLITT (J. Amer. Chem. Soc., 1938, 60, 1291—1293).—Data are recorded for a wide range of concn. "Preliminary" activity coeffs. have been calc. All the solutions show positive deviations from Raoult's law, which increase in the order  $\text{NH}_2\text{Ac}$ ,  $\text{CO}(\text{NH}_2)_2$ , urethane. E. S. H.

**Concentration of hydrogen ions in aqueous solutions of complex cobaltammines and their absorption spectra. IV. Aqueous solutions containing the ethylenediamine molecule.** T. UÉMURA and N. HIRASAWA (Bull. Chem. Soc. Japan, 1938, 13, 377—387).—The absorption curves for  $[\text{CoX}_3]\text{Cl}_2 \cdot \text{H}_2\text{O}$ ,  $[\text{CoX}_2\text{Cl}(\text{H}_2\text{O})]\text{Cl}_2$  (I),  $[\text{CoX}_2(\text{H}_2\text{O})]\text{Cl}_2$  (II),  $[\text{CoX}_2\text{Cl}_2]\text{Cl}$  (III),  $[\text{CoX}_2\text{OH}(\text{H}_2\text{O})]\text{Cl}_2 \cdot \text{H}_2\text{O}$  (IV),  $[\text{CoX}_2\text{OH}(\text{H}_2\text{O})]\text{Br}_2$  (V), and  $[\text{CoX}_2\text{NO}_2(\text{H}_2\text{O})](\text{NO}_3)_2$  [ $\text{X} = (\text{CH}_2 \cdot \text{NH}_2)_2$ ] are recorded. Variations in  $p_{\text{H}}$  have only a slight effect on the form of the curves. There is no difference between the curves of the *cis* and *trans* forms in the case of (II), (III), and (V). The cations of (I), (II), and (III) are stable in acid solutions but form the cation of (IV) in alkaline solutions. C. R. H.

**First dissociation constant of ethyl- and phenyl-substituted succinic acids.** H. HARTMAN (Rec. trav. chim., 1938, 57, 697—702).—The following vals. ( $\times 10^{-5}$ ) are recorded for the first dissociation consts. at 25°: monoethyl-, 8.3; diethyl-, 14.4 (*as*), 34.1 (racemic), 23.2 (*anti*); triethyl-, 183; phenyl-, 16.5; diphenyl-, 26.5 (racemic), 33.0 (*anti*), -succinic acid. W. R. A.

**Ultra-violet absorption spectra and dissociation constants of the ene-diol- $\alpha$ -ketonic compounds reductone and reductic, *l*-ascorbic, and *d*-glucoascorbic acids.** G. CARPÉNI (Compt. rend., 1938, 206, 1571—1573; cf. A., 1937, I, 462; 1938, I, 226; II, 147).—The change of position of the absorption maxima of these compounds with  $p_{\text{H}}$  has been investigated. The vals. of  $pK_2$  for reductone and reductic acid, deduced from these measurements, are ~12.8 and 12.9, respectively. The relations shown by the acidic properties of the four compounds confirm the lactone structure for the ascorbic acids. A. J. E. W.



**Acid-base function in non-aqueous media.** I. Autoprotolytic constant of *m*-cresol. II. Relative strengths of acids in chlorobenzene. D. C. GRIFFITHS (J.C.S., 1938, 815—818, 818—823).—I. From measurements of the e.m.f. of the cell  $H_2|0.01M\text{-}PhSO_3H|0.01M\text{-}piperidine|H_2$ , both solutions being in a 0.1M solution of *iso*amylamine benzene-sulphonate in *m*-cresol, it is deduced that the autoprotolytic const. of the ionisation of *m*-cresol ( $[C_6H_4Me\cdot OH_2][C_6H_4Me\cdot O^-]$ ) is  $10^{-14.66}$  and  $10^{-14.41}$  at 23° and 19°, respectively.

II. From measurements of the intensities of colour in solutions of 2 : 6- $C_6H_3(NO_2)_2\cdot OH$  or of bromophenol-blue in PhCl, to which various quantities of  $NH_3Bu^{\beta}$  and org. acids are added, so as to yield series of solutions of const. salt concn. and total acid concn., it is shown that the relative strengths of  $EtCO_2H$ ,  $AcOH$ ,  $BzOH$ ,  $m\text{-}OH\text{-}C_6H_4\text{-}CO_2H$ ,  $CH_2Cl\text{-}CO_2H$ ,  $CHCl_2\text{-}CO_2H$ , and  $CCl_3\text{-}CO_2H$  follow closely those in  $H_2O$ . J. W. S.

**Osmotic pressure, heat of dilution, and entropy of dilution in the systems cellulose nitrate-cyclohexanone and cellulose nitrate-acetone.** C. G. BOISSONNAS and K. H. MEYER (Z. physikal. Chem., 1938, B, 40, 108—114).—An equation is derived from which the entropy of dilution and the heat of dilution can be calc. from the temp.-dependence of the osmotic pressure. Vals. of the differential molar entropies and heats of dilution for the system cellulose nitrate-cyclohexanone are given and an error in a previous calculation for the system cellulose nitrate-COMe<sub>2</sub> (cf. A., 1937, I, 563) is indicated. H. J. E.

**Mixtures of ampholytes.** A. BOUTARIC (Ann. Soc. Sci. Bruxelles, 1938, 58, 154—160).—The mutual pptn. of ampholytes at vals. of  $[H^+]$  falling between those which correspond with the isoelectric points of the individual ampholytes has been examined in reference to the law of mass action. Max. precipitability occurs when  $[H^+] = Z$ , given by  $2[k_a k_a' k_w^2 - k_b k_b' Z^4] - Z[k_w(k_b + k_b')Z^2 - k_w^2(k_a + k_a')] = 0$ , or approx. by  $Z = \sqrt{[k_w(k_a + k_a')/(k_b + k_b')]}$  in which  $k_a$ ,  $k_b$ ,  $k_a'$ ,  $k_b'$  are the acidic and basic dissociation consts. of the two ampholytes. P. W. R.

**Acute tin pest.** II. E. COHEN and W. A. T. COHEN-DE MEESTER (Proc. K. Akad. Wetensch., Amsterdam, 1938, 41, 462—467; cf. B., 1938, 175).—The acceleration of the  $\beta \rightarrow \alpha$  change in Sn, produced by alloying with a little Al, does not occur when special precautions are taken to prevent access of traces of  $H_2O$ . The acceleration observed under ordinary conditions is due to deformation of the Sn lattice by reaction of the alloy with  $H_2O$ . E. S. H.

**Thermodynamic study of the cadmium-antimony system.** H. SELTZ and B. J. DEWITT (J. Amer. Chem. Soc., 1938, 60, 1305—1308).—The activities and relative partial mol. heat contents of Cd and Sb in their liquid alloys have been derived from e.m.f. measurements of the cells  $Cd(l)|CdCl_2 + LiCl + KCl(l)|Cd$  (in Cd-Sb liquid solutions). The heat of fusion of CdSb is 8270 g.-cal. per mol. The heat and free energy of formation of CdSb and of  $Cd_3Sb_2$  have been calc. The entropy of  $Cd_3Sb_2$  at 298.1° K. is 78.9 e.u. E. S. H.

**Two-component system sulphur dioxide and potassium iodide.** I. MORI (Bull. Inst. Phys. Chem. Res. Japan, 1938, 17, 342—354; cf. A., 1931, 799).—The v.p.-concn. relation is considered in reference to data for solutions of KI in liquid  $SO_2$  at 0°, 10°, and 20°. The mol. compound formed between -10° and 0° is claimed to be  $KI_2SO_2$ . Thermodynamic quantities are calc. I. McA.

**Binary systems containing arsenic trichloride and 5-chloro-5 : 10-dihydrophenarsazine.**—See A., 1938, II, 299.

**Vapour-liquid equilibrium. I. Apparatus for the study of systems with volatile components.** G. SCATCHARD, C. L. RAYMOND, and H. H. GILMANN. II. Chloroform-ethyl alcohol mixtures at 35°, 45°, and 55°. G. SCATCHARD and C. L. RAYMOND (J. Amer. Chem. Soc., 1938, 60, 1275—1278, 1278—1287).—I. Apparatus and technique are described.

II. Vapour and liquid compositions and equilibrium pressures have been determined. Application of the Gibbs-Duhem equation shows deviations from the perfect gas laws somewhat > those calc. from the theory of corresponding states. The excess chemical potentials, free energy, heat content, and entropy of mixing have been calc.; the last two pass through a max. and min. An explanation of the behaviour of the system, based on attraction between the mols. under certain conditions of orientation, is put forward. E. S. H.

**Binary systems of camphoric acid with acetanilide and acetmethylanilide.** D. PONTE (Boll. Chim. farm., 1938, 77, 285—287).—Camphoric acid forms eutectic mixtures with  $NHPhAc$  and  $NHPhMeAc$  which contain 44 and 45% of acid and melt at 88° and 32°, respectively. F. O. H.

**Glyceryl trinitrate and ethylene glycol dinitrate.** J. D. BRANDNER (Ind. Eng. Chem., 1938, 30, 681—684).—The v.p. of the two esters at 10—50° and of their mixtures at 40—50° have been determined. The v.p. of the trinitrate is very small, being approx. 1% of that of the dinitrate. The two esters form ideal binary mixtures. F. O. H.

**Dissociation pressures of  $BaCl_2\cdot 2H_2O$  and  $BaCl_2\cdot 2D_2O$ .** M. HOMMA and T. TAKAI (Bull. Inst. Phys. Chem. Res. Japan, 1938, 17, 331—337).—Data corresponding with  $BaCl_2\cdot 2X_2O \rightleftharpoons BaCl_2\cdot X_2O + X_2O$  ( $X = H, D$ ) over the range 25—55° agree with the respective equations:  $\log p = 10.813 - 2995.8/T$ ,  $\log p = 11.135 - 3102.5/T$ . Heats of hydration are given. I. McA.

**Vapour pressure measurements on the three-phase equilibria of the system, sodium bromide-water.** P. DINGEMANS (Rec. trav. chim., 1938, 57, 703—709).—The transition point for the dehydration of  $NaBr\cdot 2H_2O$  is 50.60° and is lowered 0.40° for each 1 wt.-% of NaCl present as impurity. The v.p. data cover the range 10—100°. The heat of hydration of  $NaBr$  at 18° is 4660 g.-cal. W. R. A.

**Equilibria in the system potassium sulphate-magnesium sulphate-calcium sulphate-water at 100°.** J. E. CONLEY, A. GABRIEL, and E. P. PARTRIDGE (J. Physical Chem., 1938, 42, 587—616).—



Part of this system has been studied at 100° and regions of stability are defined tentatively for the solid phases:  $K_2SO_4$ ;  $CaSO_4 \cdot H_2O$ ;  $K_2SO_4 \cdot 5CaSO_4 \cdot H_2O$ ;  $K_2SO_4 \cdot MgSO_4 \cdot 2CaSO_4 \cdot 2H_2O$  (I);  $CaSO_4$ . Equilibria in this system are often incomplete after 60 days, and metastable equilibria are frequently observed. The results are applied to the problem of extracting  $K_2SO_4$  from (I). J. W. S.

**Equilibrium between carbon, molten iron, and a gas containing carbon monoxide and dioxide.** G. PHRAGMÉN (Jernkont. Ann., 1936, 120, 184—189; Chem. Zentr., 1936, ii, 2006).

L. S. T.

**Determination of heat capacity by means of refractive index.** M. M. SAMGIN (J. Phys. Chem. Russ., 1938, 11, 228—230).—In the empirical equation  $C_p = a[R] + b$  the consts.  $a$  and  $b$  are characteristic for every homologous series of org. compounds.

J. J. B.

**Heats of dilution and heat contents of aqueous cadmium sulphate solutions.** T. H. DÜNKELBERGER and A. L. ROBINSON (J. Amer. Chem. Soc., 1938, 60, 1301—1305).—Intermediate heats of dilution have been determined over the range 0.8—0.0001M at 10°, 15°, and 20°, and extrapolated to infinite dilution to obtain integral vals. No definite approach to the Debye-Hückel limiting law is indicated at the lowest concns. measured. Relative partial mol. heat contents and heat capacities have been calc. and compared with published vals. derived from e.m.f. measurements. E. S. H.

**Heat capacities, entropies, and heats of dissolution of anhydrous sodium sulphate and of sodium sulphate decahydrate. Application of the third law of thermodynamics to hydrated crystals.** K. S. PITZER and L. V. COULTER (J. Amer. Chem. Soc., 1938, 60, 1310—1313).—Heat capacities from 14° to 300° K. are recorded. Heats of dissolution in  $H_2O$  at 25° are:  $Na_2SO_4$  —560±10,  $Na_2SO_4 \cdot 10H_2O$  18,840 g.-cal. per mol. The entropies of the salts have been calc. The entropy of  $Na_2SO_4 \cdot 10H_2O$ , calc. from the entropy of  $H_2O$  vapour and dissociation pressure of the hydrate together with the heats of dissolution and the entropy of  $Na_2SO_4$ , is 1.7 g.-cal. per degree > that calc. from the lower temp. heat capacities, suggesting the presence of false thermal equilibrium at low temp. This effect is ascribed to the random distribution of protons forming H linkings. The entropy of  $SO_4^{2-}$ , calc. from the above data, is  $4.4 \pm 1$  g.-cal. per degree. E. S. H.

**Integral free energies of dissolution of  $Na_2SO_4$  and  $K_2SO_4$ .** T. TAKAI (Bull. Inst. Phys. Chem. Res. Japan, 1938, 17, 338—341; cf. A., 1936, 937).—Vals. have been calc. from the differential free energies of dissolution (known) and dilution (derived from v.p. data). I. MCA.

**Heats of mixing of haloforms and polyethylene glycol ethers.** G. F. ZELHOFER and M. J. COPLEY (J. Amer. Chem. Soc., 1938, 60, 1343—1345).—The heats of mixing of  $CHCl_3$  and of  $CHCl_2F$  with  $(OMe \cdot CH_2)_2$  and  $OMe \cdot [CH_2 \cdot CH_2 \cdot O]_4 \cdot Me$ , respectively, have been determined. The high vals. obtained are ascribed to complex formation, which occurs to the

extent of 30—40%. The association is caused by the tendency to form a C—H←O linking. The positions of the max. on the curves indicate that, due to steric hindrance, it is only the alternate O atoms which are available for linking. E. S. H.

**Heats of mixing of ternary systems. V.** FISCHER (Ann. Physik, 1938, [v], 32, 347—352).—Curves are given for EtOH—MeOH— $H_2O$  mixtures. L. G. G.

**Heat of combustion of isoprene.** R. S. JESSUP (J. Res. Nat. Bur. Stand., 1938, 20, 589—597).—At 25° and 760 mm. the heat of combustion of liquid isoprene is  $3156.9 \pm 1.6$  kilo-joules per g.-mol. On the basis of a previously reported val. of the heat of combustion of rubber hydrocarbon, the heat evolved in the reaction  $x C_5H_8$  (liq.) =  $(C_5H_8)_x$  is found to be  $(74.8 \pm 6.2)x$ . Corresponding figures for gaseous isoprene are  $3182.8 \pm 1.7$  and  $(100.7 \pm 6.3)x$ . D. F. R.

**Thermal data. X. Heats of combustion and free energies at 25° of organic compounds concerned in carbohydrate metabolism.** H. M. HUFFMAN and S. W. FOX (J. Amer. Chem. Soc., 1938, 60, 1400—1403).—Heats of combustion and free energies of formation (in parentheses) recorded are: fumaric acid —194.88 (—157.23), maleic acid —189.45 (—151.32), succinic acid (—179.36),  $\alpha$ -D-glucose —305.73 (—218.72),  $\alpha$ -D-glucose hydrate —376.52 (—275.76),  $\beta$ -D-glucose (—218.32) kg.-cal. E. S. H.

**Conductance of aqueous solutions of electrolytes.** D. A. MACINNES (J. Franklin Inst., 1938, 225, 661—686).—A lecture. The factors involved and the assumptions made in the Debye-Hückel and Onsager theories of conductivity are detailed. Proofs of the validity of the Onsager equation, for strong electrolytes at low concn. and its extension to weak electrolytes and to concn. solutions are discussed. J. W. S.

**Computation of ionisation constants and limiting conductance values from conductivity measurements.** T. SHEDLOVSKY (J. Franklin Inst., 1938, 225, 739—743).—The change in equiv. conductivity ( $\Lambda$ ) with equiv. concn. ( $C$ ) for  $C \geq 0.01$  can be expressed by  $1/\Lambda = 1/\Lambda_0 + (\alpha\Lambda_0 + \beta)\sqrt{C}/\Lambda_0^2$  ( $\alpha$  and  $\beta$  are consts.). This relation is in accord with modern theory of conductivity and is valid over a greater concn. range than the Onsager equation. The modification of this relation in the computation of dissociation consts. of weak electrolytes is discussed. J. W. S.

**Solutions of electrolytes in non-aqueous solvents.** C. A. KRAUS (J. Franklin Inst., 1938, 225, 687—707).—A lecture. The influence of various properties of the solute and solvent on the conductivities of these solutions is discussed. J. W. S.

**Ionic dissociation of sodium triphenylmethyl.** E. SWIFT, jun. (J. Amer. Chem. Soc., 1938, 60, 1403—1406).—The conductances of dil. solutions of  $CPh_3Na$  in  $Et_2O$  have been measured; the calc. ionisation const. is  $1.5 \times 10^{-12}$ . The revised val. for the electron affinity of  $CPh_3$  is  $-48 \pm 5$  kg.-cal. E. S. H.

**Behaviour of complex ions in strong electric fields.** H. DIEKMANN (Ann. Physik, 1938, [v], 32,





378—392).—The conductivities of aq. solutions of cetylpyridinium chloride, and  $H_2O$ -glycerol solutions of  $MgSO_4$  have been measured with a.c. up to about 300 kv. per cm. The behaviour of the complex ions is conditioned by the Wien effect and the "separation" effect (cf. Malsch and Hartley, A., 1935, 37). The order of magnitude of these effects is obtained from dependence of the relations on the temp. and concn. L. G. G.

**Electrolytic water transport and ionic hydration numbers.** H. C. HEPBURN (Phil. Mag., 1938, [vii], 25, 1074—1096).—It is claimed that the most consistent results for the hydration of ions in aq. solution have been obtained from methods based on the transport of  $H_2O$  during electrolysis; of these the most convenient is the measurement of vol. changes in a cell incorporating a parchment-paper membrane. A sensitive form of apparatus for this purpose is described and an accurate expression for the electrolytic  $H_2O$  transport developed. Measurements have been made on NaCl and results previously obtained for  $CuSO_4$  and  $CuCl_2$  have been recalcd. The true transport and hydration nos. for these ions have been deduced and the ionic complexity of  $CuCl_2$  solution is discussed. T. H. G.

**Mechanism of the hydrogen electrode.** G. OKAMOTO (J. Fac. Sci. Hokkaido Imp. Univ., 1937, III, 2, 115—182).—An amplification of work previously published (A., 1936, 1346). The no. of active centres on a Ni electrode where the reaction  $H_2 \rightleftharpoons 2H$  can occur is calc. from the temp. coeff. of isotopic interchange between H and D, and from that of the anodic current, to be  $2-4 \times 10^{12}$  per  $cm.^2$  F. L. U.

**Normal potential of cadmium and radius of the cadmium ion in solutions of [cadmium] benzenesulphonate.** (MLLE.) M. QUINTIN (Compt. rend., 1938, 206, 1564—1566; cf. A., 1938, I, 254, 367).—Vals. of  $E_0' = E_{Ca} + (RT/2F)\log c$ , corr. for hydrolysis at high dilutions, are calc., assuming a linear relation between  $E_{Ca}$  and  $\log c$ . For vals. of  $f_+$  given by the Gronwall-La Mer-Greif formula for an ionic radius of 6.2 Å., a val. of  $E_0$  (0.3436 v.) is obtained which is const. over the concn. range studied. A. J. E. W.

**Form of the Henderson diffusion potential formula.** A. AIROLA (Svensk Kem. Tidskr., 1938, 50, 128—129; cf. A., 1937, I, 520).—An expression for the diffusion potential between two dil. solutions of uni-univalent electrolytes in terms of  $l_1, l_2, c_1$ , and  $c_2$  gives results in good agreement with experiment. M. H. M. A.

**Electromotive force of saturated Weston standard cells containing deuterium oxide.** L. H. BRICKWEDDE and G. W. VINAL (J. Res. Nat. Bur. Stand., 1938, 20, 599—605).—Measurements have been made with standard Weston cells containing up to about 6% of  $D_2O$ . Const. and reproducible results were obtained. The  $D_2O$  causes a decrease in e.m.f. amounting to 2.9  $\mu V$ . per g.-mol. %. No change in the temp. coeff. can be detected. Hysteresis is slightly less for cells containing added  $D_2O$ . D. F. R.

**Helmholtz and Nernst [equations for the e.m.f. of concentration cells].** W. D. BANCROFT (J. Physical Chem., 1938, 42, 687—691).—Nernst's equations for the e.m.f. of concn. cells coincide with those of Helmholtz only at infinite dilution, and, since the latter are thermodynamically sound, the Nernst equations can be applied only at very low concn. The Helmholtz equations involve the change of v.p. with concn., and hence the e.m.f. depends on the concn. of undissociated salt, base, or acid. The equations hold accurately for the Pb accumulator and for cells of the type  $Zn|ZnCl_2 (c_1), Hg_2Cl_2 (sat.)|Hg|Hg_2Cl_2 (sat.), ZnCl_2 (c_2)|Zn$  to high concns. Measurements of the  $p_H$  of biological solutions are inaccurate to an unknown extent. J. W. S.

**[Cell] combinations of silver with platinum and nickel in aqueous potassium iodide, and their electrostatic character.** (MLLE.) S. VEIL (Compt. rend., 1938, 206, 1625—1627).—The variation of the e.m.f.  $E$  of the cell  $Ag-KI aq. (c)-Pt$  with  $c$  is in agreement with the relation previously found for the cell  $Cu-CuCl_2-Pt$  (A., 1938, I, 143), viz.,  $\log [(E - E_{H_2O}) / (E_\sigma - E_{H_2O})] \propto \log (c/\sigma)$  ( $E_{H_2O}$  and  $E_\sigma$  represent the vals. of  $E$  for  $c = 0$  and saturation, respectively). This shows that the relation is not dependent on one electrode being in contact with its own ions. Ag is positive with respect to Ni in aq.  $NiSO_4$  or  $NH_3$ , but the polarity is reversed in aq. KI, indicating that the relative Volta polarities of two metals may vary in different solutions. A. J. E. W.

**Theory of the electrolytic double layer and of the potential-determining ionic adsorption.** J. KASPAR (Helv. Chim. Acta, 1938, 21, 650—663).—Theoretical. The adsorption theory of the double layer is developed in a generalised form and relations between the potential-determining ionic adsorption and the structure of the double layer are indicated. J. W. S.

**Redox potentials of complex iron salts with the sodium salts of organic acids.** W. REINDERS and (MISS) C. H. DE MINJER (Rec. trav. chim., 1938, 57, 594—603).—The redox potential of a  $FeSO_4-Fe_2(SO_4)_3$  solution decreases progressively as increasing amounts of a neutral alkali salt of a polybasic or OH-acid are added. Such solutions have great buffer capacity against oxidation or reduction. Vals. obtained on addition of Na salts of  $H_2C_2O_4$ , malonic, tartaric, citric, and lactic acids have been determined potentiometrically. The influence of addition of  $H_2SO_4$  and NaOH on the buffered solutions is discussed. Complex ferric ions are formed with citric,  $Fe_2(C_6H_5O_7)_3'''$ , malonic,  $Fe(C_3H_2O_4)_3'''$ , and oxalic acids, and  $Fe(C_2O_4)_3'''$ . W. R. A.

**Oxidation-reduction potential of the system  $d$ -alanine  $\rightleftharpoons$  ammonium pyruvate.** R. WURMSER and S. FILITTI-WURMSER (Compt. rend. Soc. Biol., 1938, 128, 133—135).—The vals. obtained for  $E_0$  at 37° are -0.066 v. and -0.048 v. at  $p_H$  7.3 and 7.0, respectively. The calc. val. at 25° is -0.040 v. H. G. R.

**Value of diffusion currents observed during electrolysis by means of the dropping mercury**



electrode. **Polarographic study.** D. ILKOVIC (J. Chim. phys., 1938, 35, 129—135).—Mathematical.

**Measurements of the ionisation constant of benzoic acid using silver chloride electrodes.** H. T. BRISCOE and J. S. PEAKE (J. Physical Chem., 1938, 42, 637—640).—From measurements of the e.m.f. of cells of the type

$H_2|BzOH(m_1), NaOBz(m_2), NaCl(m_3)|AgCl, Ag$  it is deduced that the dissociation const. of BzOH at 25° is  $6.05 \times 10^{-5}$ . J. W. S.

**Acidity measurements with the hydrogen electrode in mixtures of acetic acid and acetic anhydride.** J. RUSSELL and A. E. CAMERON (J. Amer. Chem. Soc., 1938, 60, 1345—1348).— $H_2SO_4$ ,  $HClO_4$ , and certain sulphonic acids show increased acidity in the presence of  $Ac_2O$ , which is not accounted for by dehydration. With  $H_2SO_4$  the effect is ascribed to the formation of  $AcSO_3\cdot OH$ , which undergoes rearrangement to  $OH\cdot SO_2\cdot CH_2\cdot CO_2H$ . Attention is directed to the significance of this effect in investigations of the influence of  $H^+$  activity on acetylation reaction rates. E. S. H.

**Comparative study of some complex bases.** (MLLE.) J. BRIGANDO (Compt. rend., 1938, 206, 1467—1469).—The potentiometric and conductometric titration curves of  $[CoX_3](OH)_3$  [ $X = (NH_3)_2, (CH_2\cdot NH_2)_2$  (I),  $C_3H_6(NH_2)_2$ ] with  $HCl$  are identical, showing that the strengths of the complex bases are independent of the amine forming the complex ion; curves for the titration of aq.  $NH_3$  and (I) with  $HCl$  are not identical, and are different from those given by the complex bases. The continuous absorption of the latter in the ultra-violet shows an abrupt decrease on passing the neutral point; with (I) the absorption spectrum changes progressively with addition of  $HCl$ . A. J. E. W.

**Irreversibility of photographic development in elon solutions containing sodium sulphite.** A. E. CAMERON (J. Physical Chem., 1938, 42, 629—635; cf. A., 1938, I, 314).—Strips of film have been exposed for various times, given standard development, rinsed in 1%  $AcOH$ , washed and dried, and then immersed for 15.5 hr. in solutions containing  $p-NHMe\cdot C_6H_4\cdot OH$  (I) 8 g.,  $KBr$  8 g., and  $Na_2SO_3$  6.25 g. per l., and of varying  $p_H$ , agitated by air or  $N_2$ . Development continues only at  $p_H > 5.0$ , but at lower  $p_H$  there is no reduction in the intensity of the image. The potential of a Pt wire in this solution is  $-0.050$  v. Tenfold increase in the  $[Na_2SO_3]$  does not affect this min.  $p_H$  val. for development, but it is reduced to 4.8 by fivefold increase in the concn. of (I). Changes in the electrode potential during contact with the film are attributed to changes in the  $[Ag^+]$ . None of the potentials observed accords with the val.  $-0.150$  v. found for  $p-NH_2\cdot C_6H_4\cdot OH$  solutions at the reversal point (A., 1937, I, 471). It is concluded that no reversible oxidation-reduction system exists in solutions of (I) and  $Na_2SO_3$ . J. W. S.

**A new phenomenon of an electrical nature and a new effect shown by metals.** G. PICCARDI (Gazzetta, 1938, 68, 246—263).—Contact with a dielectric such as glass, which has been polarised

electrostatically by various means, induces a change in certain physical and chemical properties of  $H_2O$  and other polar liquids. These changes are not perfectly elastic and may persist for an appreciable time after contact with the polarised dielectric has ceased, and they may be induced across various kinds of diaphragms. With metallic diaphragms a new type of effect is produced. Changes in the behaviour of  $H_2O$  in biological processes can also be induced by contact with a dielectric in the above manner. O. J. W.

**Motor-electric effect.** J. KASPAR (Helv. Chim. Acta, 1938, 21, 733—747).—The so-called motor-electric effect is shown to comprise an electro-kinetic transverse effect, due to disturbance of the double layer at the electrode-solution interface, and a convection effect due to disturbance of diffusion layers in the solution. The second effect can be eliminated in systems in true electro-chemical equilibrium, a condition attainable in reasonable time only with a metal in contact with a solution of its ion. In the case of  $Ag-Ag^+$  ion systems no electro-kinetic effect could be observed during the relative movement of the phases. J. W. S.

**Chemical reaction considered as an intramolecular diffusion phenomenon. III. Calculation of absolute reaction rates by means of the diffusion hypothesis and quantum theory.** J. A. CHRISTIANSEN (Z. physikal. Chem., 1938, B, 40, 183—196; cf. A., 1938, I, 35).—Theoretical. The diffusion hypothesis is applied in the special case of quasi-elastic binding to the numerical calculation of reaction velocity as a function of temp. H. J. E.

**Kinetics of the explosive reaction between hydrogen and oxygen sensitised by nitrogen peroxide.** R. J. W. NORRISH (J. Amer. Chem. Soc., 1938, 60, 1513).—Polemical (cf. A., 1937, I, 621). E. S. H.

**Kinetics of the decomposition reactions of the lower paraffins. I. *n*-Butane.** E. W. R. STEACHIE and I. E. PUDDINGTON (Canad. J. Res., 1938, 16, B, 176—193).—The kinetics of the thermal decomp. of *n*-butane have been studied for pressures 5—60 mm. and temp. 513—572°. An expression is given for the first-order reaction coeffs., which agree with the results of Frey and Hepp, but differ from those of Paul and Marek. Chain processes appear to be involved since the rate of reaction falls rapidly with diminishing pressure and the first-order coeffs. also fall rapidly as the reaction proceeds. The reaction products are  $H_2$ ,  $CH_4$ ,  $C_3H_6$ ,  $C_2H_4$ , and  $C_2H_6$  and are independent of temp. and pressure over the range covered. The reaction mechanism is discussed and compared with that of other paraffin decoms. T. H. G.

**Extinction of propylene flames by diluting with nitrogen and carbon dioxide: explosive properties of propylene.** G. W. JONES and R. E. KENNEDY (U.S. Bur. Mines, Rept. Invest. 3395, 1938, 14 pp.).—14 vols. of  $N_2$  or 7.7 vols. of  $CO_2$  must be added to each vol. of  $C_3H_6$  to make all mixtures with air non-inflammable. Inflammability limit curves and tables which have been constructed show



that the added inert gas has little effect in raising the lower limit of inflammability except at high concns. of inert gas, but that the lowering of the upper limit is almost directly  $\propto$  the amount of added inert gas. The max. excess pressure developed by igniting  $C_3H_6$ -air mixtures is 94 lb. per sq. in., and is obtained with mixtures containing 4.90—5.28% of  $C_3H_6$ . The ignition temp. of  $C_3H_6$ -air and  $C_3H_6$ - $O_2$  mixtures decreases with increasing  $[C_3H_6]$ , the ignition temp. for a given  $C_3H_6$ - $O_2$  mixture being  $<$  that for a similar  $C_3H_6$ -air mixture. C. R. H.

**Influence of the pressure value on the velocity of flame propagation under constant pressure, with uniform conditions, in mixtures of propane and town gas with air.** G. RIBAUD and H. GAUDRY (Compt. rend., 1938, 206, 1648—1649).—Velocities of propagation ( $v$ ) (17—56 cm. per sec. in a 9-mm. tube) for 3—6%  $C_3H_8$ -air mixtures at 1—11 kg. per sq. cm. pressure ( $p$ ) are recorded;  $v$  decreases with increasing  $p$ . Reproducible results could not be obtained with a 20% town gas-air mixture, but for  $p = 1$ —11 kg. per sq. cm.,  $v$  is const. (1 m. per sec.) within  $\pm 20\%$ . A. J. E. W.

**Kinetics in ionic systems.** V. K. LA MER (J. Franklin Inst., 1938, 225, 709—737).—A lecture. The Brønsted theory of reaction kinetics in ionic systems, and its subsequent development, are discussed. J. W. S.

**Kinetics of oxidation of iodide by chlorate ion in presence of catalysts.** K. WEBER, F. LISZT, and I. BALZER (Arh. Hemiju, 1938, 12, 12—22).—The velocity of the reaction  $KClO_3 + 6KI + 3H_2O \rightarrow KCl + 6KOH + 6I$  has been determined, in presence of excess of KI and HCl, and with  $VOSO_4$  catalyst. The temp. coeff. is 2.87 for the interval 25—35°. PhOH and *p*-nitrophenol do not affect the reaction, whilst *m*- and *p*- $C_6H_4(OH)_2$  inhibit it; this is ascribed to their oxidation by  $KClO_3$ , the effective concn. of which is thus lowered.  $MnSO_4$  and  $NiSO_4$  retard the reaction, and are regarded as negative catalysts. R. T.

**Comparison of the rates of hydrolysis of methyl, ethyl, isopropyl, and tert.-butyl bromides in acetone. Water catalysis in such reactions.** W. TAYLOR (J.C.S., 1938, 840—842).—The second-order hydrolysis velocity coeffs. are  $Me > Et < Pr^{\beta} \lll Bu^{\gamma}$  for reactions in  $COMe_2$  containing 5% and 10% of  $H_2O$ . The data can be explained satisfactorily by assuming that the hydrolysis is bimol., and that the min. at Et is due to the decreasing facility of attack of the  $\alpha$ -C by the OH of the reagent  $H_2O$  mol., together with concurrently increasing facility of attack of the halogen of the alkyl halide by the H of the  $H_2O$  down the series Me, Et,  $Pr^{\beta}$ ,  $Bu^{\gamma}$ . The catalytic influence of  $H_2O$  is due to the dissociating effect of  $H_2O$  on the hydroxylic reagent  $R\cdot OH$ , where R may be H, alkyl, or acyl, i.e.,  $(R\cdot OH)_n \rightleftharpoons nR\cdot OH$ . In other words,  $H_2O$  can catalyse the reaction by bringing about dissociation of the  $H_2O$  already in solution in the org. solvent. C. R. H.

**Kinetics of two ionic exchange reactions of the methyl halides in water.** E. A. MOELWYN-HUGHES (J.C.S., 1938, 779—784).—The replacements

of Br in MeBr by I and of I in MeI by Br have been studied in aq. solution and over a range of temp. Although complicated by hydrolysis of the halides, the reactions have been shown to be bimol. and each reaction is opposed by the other. The velocity coeffs. for the two reactions,  $k_2$  and  $k_1$ , respectively, give vals. agreeing with the empirical relations  $k_2 = 1.68 \times 10^{10} \times e^{-18,260/RT}$ ,  $k_1 = 6.02 \times 10^9 \times e^{-19,310/RT}$ , and  $k_2/k_1 = 2.79 \times e^{-1050/RT}$ . C. R. H.

**Rates of hydrolysis and extinction coefficients of halogeno-fatty acids in the quartz-glass ultra-violet.** A. KAILAN and F. KUNZE (Monatsh., 1938, 71, 373—423).—The rates of hydrolysis under ultra-violet radiation at 10° of aq. mono-, di-, and tri-chloro-, mono-, di-, and tri-bromo-, mono- and di-iodo-acetic acids,  $\alpha$ - and  $\beta$ -chloro-,  $\alpha$ -bromo-,  $\alpha\beta$ -dibromo-, and  $\alpha$ -iodo-propionic acids, and  $CHCl_3$  have been determined. The quantum yields have been evaluated, and the extinction coeffs. measured at different  $\lambda$ . Below certain concns., which have been determined for each substance, the rate of hydrolysis in a quartz flask is almost independent of concn. At higher concns. the rate increases with increasing no. of substituent halogen atoms and in the order  $Cl < Br < I$ , with the exception of  $CH_2I\cdot CO_2H$ , which hydrolyses slowly and gives the smallest quantum yield. The greatest rate of hydrolysis is given by  $CBR_3\cdot CO_2H$ . All the acids yield small amounts of  $CO_2$ . No relation between quantum yield and absorption was found. E. S. H.

**Velocity of the Cannizzaro reaction.** J. J. BLANKSMA and W. H. ZAAIJER (Rec. trav. chim., 1938, 57, 727—728).—The velocity of the Cannizzaro reaction at 100° in 50% MeOH under the influence of  $Ba(OH)_2$ ,  $Sr(OH)_2$ , and  $Ca(OH)_2$  has been studied.  $HCO_2H$  is formed in detectable amounts. The reaction rates with  $Ba(OH)_2$  and  $Sr(OH)_2$  are of the same order. In 50% EtOH the reaction with  $Ba(OH)_2$  is faster than in 50% MeOH but reduction of  $PhCHO$  is more evident. No appreciable alteration in velocity results from variation in the  $H_2O$  content of the alcohol; the reactions with  $Ba(OH)_2$  in 40% and 50% MeOH have the same velocities. The reaction is faster with alkaline earth hydroxides than with alkali hydroxides (A., 1937, II, 195). MeOH is a better solvent than EtOH because with the latter MeCHO is formed and is readily converted into a resin. W. R. A.

**Unsaturated sulphones. III. Measurement of the velocity of oxidation by peracetic acid.** E. DE R. VAN ZUYDEWIJN (Rec. trav. chim., 1938, 57, 806—810).—The velocity of oxidation of sulphones is very slow and secondary reactions cause the results to be irreproducible; factors responsible for this are discussed. W. R. A.

**Influence of directing groups on nuclear reactivity in oriented aromatic substitutions.** V. Dilatometric investigation of the kinetics of aromatic nitration especially in nitromethane solution. G. A. BENFORD and C. K. INGOLD (J.C.S., 1938, 929—955).—Previous work on dilatometry and on nitration kinetics is reviewed. A general dilatometric method has been developed for studying aromatic nitration. The nitrations of  $C_6H_6$ ,



PhMe, and PhEt in MeNO<sub>2</sub> solution are zero-order reactions and are retarded by HNO<sub>2</sub> without disturbing the zero-order law. The abs. rates of nitration are equal under the same conditions with regard to temp., [HNO<sub>3</sub>], and [HNO<sub>2</sub>]. The effective reaction order for the nitration of the halogen-substituted benzenes is >0 and <1, and invariably rises during the course of the reaction. In these reactions also, HNO<sub>2</sub> retards nitration. The data are discussed theoretically and a series of chain reactions is formulated which explains the data, the fundamental sequence of chain initiation, propagation, and destruction being MeNO<sub>2</sub> → CH<sub>2</sub>:NO·OH (catalysed by HNO<sub>3</sub>); CH<sub>2</sub>:NO·OH + HNO<sub>3</sub> → CH<sub>2</sub>:NO·ONO<sub>2</sub> + H<sub>2</sub>O; CH<sub>2</sub>:NO·ONO<sub>2</sub> + ArH → CH<sub>2</sub>:NO·OH + ArNO<sub>2</sub> (ArH is the compound nitrated); and finally CH<sub>2</sub>:NO·OH → MeNO<sub>2</sub> (catalysed by HNO<sub>3</sub>) or some reaction between CH<sub>2</sub>:NO·OH and NO or NO<sub>2</sub>. C. R. H.

**Kinetics of nitration of 1-nitroanthraquinone.**—See A., 1938, II, 286.

**Liquid-phase reactions at high pressures.**  
**III. Esterification of acetic acid.** S. PENG, R. H. SAPIRO, R. P. LINSTEAD, and D. M. NEWITT (J.C.S., 1938, 784—791).—For pressures >4000 atm., the rate of esterification of AcOH between 70° and 80° increases with increase in pressure. The increase becomes less on ascending the series of primary alcohols and is greater for *iso*- and *sec*-alcohols than for primary alcohols. For a given pressure the velocity coeffs. for the primary alcohols are of the same order. The activation energy, *E*, and the const., *A*, of the Arrhenius equation ( $k = Ae^{-E/RT}$ ) increase with pressure, the vals. for *E* for the primary alcohols increasing progressively on ascending the series at all pressures. The vals. of *A* are discussed with reference to collision frequency, it being shown that increase in *A* with pressure can, in certain cases, be accounted for by increase in collision frequency. A linear relation exists between *E* and log *A*. C. R. H.

**Experiments with heavy water on the acid hydrolysis of esters and the alkaline decomposition of diacetone alcohol.** W. E. NELSON and J. A. V. BUTLER (J.C.S., 1938, 957—962).—The velocity of hydrolysis of HCO<sub>2</sub>Et and MeOAc in H(D)Cl solutions increases with increasing D content of the solution, the shapes of the velocity-[D] curves being in reasonable agreement with calc. curves, indicating that the medium is in thermodynamic equilibrium with a complex, probably R·CO<sub>2</sub>(H')·R', and that the reaction is not subject to general acid catalysis. Data for the rate of decomp. of diacetone alcohol (I) in NaOH(D) solutions favour the view that the reaction does not proceed by way of an equilibrium complex, but the differences between observed and calc. curves are too small to be conclusive. Since the transfer of D' from (I) to OH' or OD' is slower than the corresponding transfer of H', "heavy" (I) reacts more slowly than "light" (I), and since the rate of transfer of H' to OD' is more rapid than to OH', "light" (I) reacts more quickly in D<sub>2</sub>O than in H<sub>2</sub>O. The enolisation of the terminal COMe<sub>2</sub> is not catalysed by acids because the O is already in OH form.

C. R. H.

**Activation energy of organic reactions. I. Electronic theories of organic chemistry from the standpoint of chemical kinetics.** C. N. HINSHELWOOD, K. J. LAIDLER, and E. W. TIMM. **II. Formation of quaternary ammonium salts.** K. J. LAIDLER and C. N. HINSHELWOOD. **III. Kinetics of acid hydrolysis of esters.** E. W. TIMM and C. N. HINSHELWOOD (J.C.S., 1938, 848—858, 858—862, 862—869).—I. An attempt is made to correlate certain aspects of the electronic theory of org. reactions with the modern analysis of activation energy. Changes of reactivity resulting from electronic displacements as a result of substitution are primarily due to changes in activation energy, which can be regarded as being made up of two parts, the energy required to overcome the repulsion of the approaching reagent, and that required to weaken the existing bond. The conclusions which follow from a theoretical consideration of the balance between these two kinds of energy are applied to available experimental data.

II. The rate of quaternary salt formation between NEt<sub>3</sub> or C<sub>5</sub>H<sub>5</sub>N and MeI or Pr<sup>3</sup>I in C<sub>6</sub>H<sub>6</sub> and PhNO<sub>2</sub> has been investigated. Activation energies, *E*, were determined from data at four temp. The observed changes in *E* are discussed with reference to the authors' theory.

III. The acid hydrolysis of EtOAc and the three chloroacetates in aq. EtOH, of nine substituted Et benzoates in aq. EtOH and aq. COMe<sub>2</sub>, and of three substituted Me benzoates in aq. MeOH has been investigated, and the data have been compared with data for alkaline hydrolysis. The order of the *p*-substituents in their effect on the val. of *E* is OMe > Me > H > halogen > NO<sub>2</sub>. *E* is higher in acid than in alkaline hydrolysis and the effect of the substituents is smaller. The effect of the solvent is opposite to that observed in alkaline hydrolysis. The change in reactivity due to substitution and to change of solvent is discussed on the basis of the author's theory.

C. R. H.

**Nitration of the halogeno-benzenes.**—See A., 1938, II, 313.

**Reaction between *tert*-butyl chloride and hydrolytic solvents.**—See A., 1938, II, 304.

**Heterogeneous reactions of the type  $A_{\text{solid}} + B_{\text{gas}} = C_{\text{solid}}$ .** **III. Experimental detection of the elementary steps of the composite process.** J. ZAWADZKI and S. BRETSZNAJDER (Z. physikal. Chem., 1938, B, 40, 158—182; cf. A., 1933, 911).—Data on solid-gas reactions are reviewed, with special reference to hysteresis phenomena. The rôles of activated and normal adsorption and of lattice changes as rate-determining processes are discussed for the case of the reaction of metallic oxides with CO<sub>2</sub> and SO<sub>2</sub>.

H. J. E.

**Mechanism of corrosion of metals which decompose water.** E. PLANK and A. URMÁNCZY (Z. anorg. Chem., 1938, 238, 51—64).—Measurements of the velocity of dissolution of Tl in aq. HCl, H<sub>2</sub>SO<sub>4</sub>, and HNO<sub>3</sub>, respectively, at different concns. and 25° support Urmánczy's theory of the mechanism (cf. A., 1938, I, 257, 316). The influence of stirring on the velocity of dissolution,  $\phi$ , in 0.26N-HNO<sub>3</sub> is given by



$\phi = A + B\sqrt{N} + C\sqrt[3]{N}$ , where  $N$  is the no. of revolutions per min. and  $A$ ,  $B$ , and  $C$  are consts. E. S. H.

**Velocity of dissolution of lead in acids.** IV. G. TEDeschi (Gazzetta, 1938, 68, 157—166; cf. A., 1938, I, 257).—The relation  $V = Ka^2$  is derived, where  $V$  = velocity of dissolution of a metal in an acid,  $K$  = a const., and  $a$  = activity of the acid anions. This expression is confirmed by data for the dissolution of Pb in HCl and in  $H_2SO_4$ , and of Al in HCl. Theories of the dissolution of metals in acids are discussed. O. J. W.

**Thermal dissociation of ferric oxide.** F. MEUNIER and O. L. BIHET (Congr. Chim. ind. Bruxelles, 1935, 15, II, 944—951; Chem. Zentr., 1936, ii, 1874).—This has been investigated by the streaming method of Kleffner and Kohlmeyer (A., 1933, 40). The loss in wt. of the  $Fe_2O_3$  increases with temp. and with the quantity of the  $N_2$  passed over the  $Fe_2O_3$ , but owing to a back-diffusion of the liberated  $O_2$ , never reaches the max. val. of 3.33% required for the formation of pure  $Fe_3O_4$ . The introduction of metallic Ni prevents this back-diffusion. The thermal dissociation of  $Fe_2O_3$  begins at 600°, but proceeds very slowly at temp. <1000°; above 1200°, velocities are very high. Dissociation proceeds in the stages  $Fe_2O_3 \rightleftharpoons$  saturated solution of  $Fe_3O_4$  in  $Fe_2O_3$  (I) +  $O_2$ ; (I)  $\rightleftharpoons$  saturated solution of  $Fe_2O_3$  in  $Fe_3O_4$  (II) +  $O_2$ ; and (II)  $\rightleftharpoons$   $Fe_3O_4$  +  $O_2$ . L. S. T.

**Relation between rates of general basic catalysis in different reactions.** H. L. PFLUGER (J. Amer. Chem. Soc., 1938, 60, 1513—1514).—A straight line is obtained when the catalytic consts. for the mutarotation of glucose at 18° are plotted logarithmically against the corresponding catalytic consts. for the decomp. of nitramide at 15°, both in aq. solution. E. S. H.

**Reactions in concentrated sulphuric acid.** III. Combinations of two and three catalysts in combustion of carbon monoxide. J. MILBAUER (Chem. Obzor, 1936, 11, 1—6; Chem. Zentr., 1936, ii, 1904).—The oxidation of CO in conc.  $H_2SO_4$  at 237° in presence of  $SeO_2$ ,  $As_2O_3$ ,  $As_2O_5$ , Pd,  $Ag_2SO_4$ ,  $HgSO_4$ ,  $CuSO_4$ , V, Sn, and combinations of these is described. A. H. C.

**Induced oxidation of iodobenzene during the oxidation of benzaldehyde in an atmosphere of oxygen.** W. P. JORISSEN and (MISS) A. C. B. DEKKING (Rec. trav. chim., 1938, 57, 829—833).—PhCHO on oxidation in  $O_2$  yields  $BzO_2H$ . The oxidation of PhI by  $BzO_2H$  yields iodoxybenzene. The reaction between PhI, PhCHO, and  $O_2$  has been studied manometrically and in  $CHCl_3$  and  $COMe_2$ . Induced oxidation of PhI occurs, the products being the mono- and di-benzoates of iodosobenzene. W. R. A.

**Function of a catalyst.** S. KOMATSU and K. MITSUI (Rec. trav. chim., 1938, 57, 586—590).—The catalytic reduction of styrene and CPhMe by Ni, Cu, Zn, Al, Mg, and anhyd.  $CuCl_2$ ,  $ZnCl_2$ ,  $MgCl_2$ , and  $AlCl_3$  has been investigated. A qual relation appears to exist between the catalytic activity of chlorides

towards reduction of the C:C and C:O groups and their halochromy. W. R. A.

**Form assumed by manganese dioxide used as a catalyst in the dry decomposition of potassium chlorate.** G. DENIGÈS (Bull. Trav. Soc. Pharm. Bordeaux, 1936, 74, 93—112; Chem. Zentr., 1936, ii, 1875—1876).—Spectrograms reveal the formation of a permanganate when  $MnO_2$  is used as a catalyst in the decomp. of  $KClO_3$ . The free acid is not formed, as other investigations show it to be no longer stable at the temp. required for the catalytic decomp. of  $KClO_3$ .  $Mn_2O_7$ , also, is not formed.  $KMnO_4$  may be produced, but only in small amounts which are considered to be not responsible for the catalytic action of  $MnO_2$ . Solid  $KMnO_4$  dissolves in molten  $KClO_3$  without any sign of decomp. at temp. > those at which the addition of  $MnO_2$  brings about visible and energetic evolution of  $O_2$ . It is assumed that  $Mn(MnO_4)_2$  is formed as an intermediate product in the decomp. of  $KClO_3$ . This, and the regeneration of  $MnO_2$ , are represented by  $9MnO_2 + 2KClO_3 = 3[(MnO_4)_2Mn] + 2KCl$  and  $3[(MnO_4)_2Mn] = 9MnO_2 + 3O_2$ . L. S. T.

**Catalytic toxicity and chemical structure.** IV. Relative toxicity of simple phosphorus, arsenic, antimony, and bismuth compounds. E. B. MAXTED and A. MARSDEN (J.C.S., 1938, 839—840).—The poisoning, by hydrides, of a Pt catalyst during the hydrogenation of crotonic acid has been investigated. The relative toxicity per g.-atom of poison increases in the order  $P = As < Sb < Bi$ . C. R. H.

**Supposed activation of hydrogen bromide by oxygen.** Y. URUSHIBARA and O. SIMAMURA (Bull. Chem. Soc. Japan, 1938, 13, 407).—In absence of  $O_2$  and light reduced Ni and HBr do not react, but in presence of  $O_2$  NiBr<sub>2</sub> and  $H_2$  only are formed, the  $O_2$  apparently activating the HBr. C. R. H.

**Addition of hydrogen bromide to undecenoic acid in toluene.** II. Influence of anti-oxidants on the actions of oxygen and reduced nickel. Y. URUSHIBARA and M. TAKEBAYASHI (Bull. Chem. Soc. Japan, 1938, 13, 404—406).—HBr and pure undecenoic acid, in the dark, in PhMe at 0° for 1 hr., give in presence of (a) air or (b) reduced Ni, 97 and 34% yields of the 11-bromoundecenoic acid, respectively.  $NHPh_2$ , *o*- and *p*- $C_6H_4(OH)_2$  reduce the yields in (a) to 65, 6, and 3%, and in (b) to 31, 8, and 10%, respectively. The weak inhibiting effect of  $NHPh_2$  on the action of  $O_2$  is explained (cf. Ashton and Smith, A., 1934, 631). A. T. P.

**Addition of hydrogen bromide to allyl bromide in presence of various substances.** VII. Effect of nickel filings, and influence of anti-oxidants on the actions of oxygen and reduced nickel. Y. URUSHIBARA and M. TAKEBAYASHI (Bull. Chem. Soc. Japan, 1938, 13, 400—404; cf. A., 1937, II, 270).— $CH_2=CH-CH_2Br$  and HBr react in the dark at 12—15° for 3 days in presence of  $O_2$ , reduced Ni, or Ni filings, to give 96, 91, and 68% yields of  $CH_2(CH_2Br)_2$  (I), respectively. Addition of  $NHPh_2$ , and *o*- and *p*- $C_6H_4(OH)_2$  diminishes the yields of (I) to 9, 9, and 7% in presence of  $O_2$ , and to 81, 12, and 20%, respect-



ively, in presence of reduced Ni (cf. Kharasch and Mayo, A., 1933, 805). A. T. P.

**Catalytic formation of methane from carbon monoxide and hydrogen. IV. Specific nature of the accelerating influence on nickel catalysts in the reaction between water vapour and equal volumes of carbon monoxide and hydrogen.** K. M. CHAKRAVARTY (Z. anorg. Chem., 1938, 237, 381—387).—In mixtures of CO, H<sub>2</sub>, and H<sub>2</sub>O, the presence of Th, Ce, or Al oxides in Ni-sugar charcoal catalysts favours the reactions  $C + H_2O \rightleftharpoons CO + H_2$  and  $C + 2H_2O \rightleftharpoons CO_2 + 2H_2$ , whereas the presence of K<sub>2</sub>CO<sub>3</sub> favours the reaction  $2CO \rightleftharpoons C + CO_2$ . A Ni catalyst containing ThO<sub>2</sub> and CeO<sub>2</sub> (99:1) but no C is effective for the reactions  $CO + H_2O \rightleftharpoons CO_2 + H_2$  and  $2CO + 2H_2 \rightleftharpoons CH_4 + CO_2$ . F. J. G.

**Catalytic activity of aqueous tungsten trioxide suspensions.** F. REIFF and R. NEUMANN (Z. anorg. Chem., 1938, 238, 103—112).—The accelerating influence on the inversion of sucrose depends on the relative amounts of molecularly dissolved, colloiddally dissolved, and suspended WO<sub>3</sub>, which contribute 1%, 50—67%, and 34—50%, respectively. Catalysis traced to colloidal WO<sub>3</sub> is independent of [NH<sub>3</sub>], but that due to suspended WO<sub>3</sub> varies with [NH<sub>3</sub>], reaching a max. at 1%. E. S. H.

**Catalytic oxidation of hydrocarbons in the vapour phase.**—See B., 1938, 762.

**Catalytic polymerisation of ethylene.**—See B., 1938, 762.

**Catalysis in hydrocarbon chemistry.**—See B., 1938, 754.

**Stability of butadiene in presence of Lebedev's catalyst.**—See B., 1938, 762.

**Progress of polarisation of the nickel anode in the electrolysis of water in alkaline solutions.** G. GRUBE and A. VOGT (Z. Elektrochem., 1938, 44, 353—360).—When alkaline solutions are electrolysed with a Ni anode and an Fe cathode O<sub>2</sub> formation at the anode brings about an increase of terminal voltage accompanied by formation at the anode of a brown layer consisting of a solid solution of NiO<sub>2</sub> in Ni<sub>2</sub>O<sub>3</sub> (cf. Foerster, A., 1908, ii, 146). Ni is not considered to be completely passive, traces passing into solution forming Ni(OH)<sub>2</sub>, which is oxidised at the anode to a higher oxide which facilitates O<sub>2</sub> liberation. C. R. H.

**Electrolytic preparation and properties of iron phosphide, PFe.** J. L. ANDRIEUX and M. CHÈNE (Compt. rend., 1938, 206, 1562—1563; cf. A., 1934, 964).—PFe has been prepared by electrolysis at 850—900° of mixtures of HPO<sub>3</sub> or NaPO<sub>3</sub> with Fe<sub>2</sub>O<sub>3</sub> or FeCl<sub>2</sub>, with or without added NaF. The electrolysis is carried out in a Crucible, used as cathode, with a C or Fe anode, using 15—25 amp. at 4—5 v. PFe crystallises in steel-grey feebly magnetic needles, ρ 6.0. It resists atm. oxidation at 100°, and the action of NaOH, Na<sub>2</sub>CO<sub>3</sub>, KNO<sub>3</sub>, Na<sub>2</sub>O<sub>2</sub>, HNO<sub>3</sub>, and HCl; it is attacked by boiling conc. H<sub>2</sub>SO<sub>4</sub>, aqua regia, and alkali persulphates. A. J. E. W.

**Preparation of thin layers of thorium and actinium by electrolysis in ethyl alcohol.** (MME.)

S. COTELLE and M. HAÏSSINSKY (Compt. rend., 1938, 206, 1644—1646).—Uniform coherent deposits containing Th are formed on electrolysis of an EtOH solution of Th(NO<sub>3</sub>)<sub>4</sub> (3—5 mg. per c.c.) containing 15—25% COMe<sub>2</sub>, using a Ag or Pt cathode and a c.d. of 1—2 ma. per sq. cm. Similar deposits containing Ac are obtained using a mixture of La and meso-Th-2 nitrates; meso-Th-2 may also be deposited without La by using NaNO<sub>3</sub> instead of La(NO<sub>3</sub>)<sub>3</sub> in the meso-Th separation. A. J. E. W.

**Electrolytic oxidation.**—See B., 1938, 807.

**Rochelle salt copper plating bath. III. Anode behaviour. IV. Current efficiencies.**—See B., 1938, 803.

**Anodic behaviour in cyanide copper-plating baths.**—See B., 1938, 803.

**Oxide films on rustless steels and anomalies in their use as cathode materials.**—See B., 1938, 803.

**Chromium plating with special reference to black chromium.**—See B., 1938, 803.

**Anodic corrosion of commercial manganese during electrolysis.**—See B., 1938, 804.

**Catalytic decomposition of cassiterite-containing tin ores by cathodal reduction.**—See B., 1938, 807.

**Behaviour of lead anodes in a [zinc] sulphate electrolyte. Influence of cobalt salts.**—See B., 1938, 807.

**Electrolysis of potassium alkyl phthalates.**—See A., 1938, II, 325.

**Chemical actions of hydrogen excited by electrodeless discharge.** H. NAGAOKA and T. MISHIMA (Proc. Imp. Acad. Tokyo, 1938, 14, 128—133).—The action of at. H on various salts has been examined spectroscopically; the spectra are characteristic of the elements forming the salts. A correlation between the spattering or non-spattering of the metal, produced by reduction, and the heat of formation of the salt is suggested. Certain salts exhibited a characteristic fluorescence. W. R. A.

**Chemical action of electrical discharges. XVI. Production of hydrogen cyanide by the electric arc, at various frequencies, in mixtures of hydrocarbon vapours, nitrogen, and hydrogen.** E. BRINER, J. DESBAILLETS, and M. WERTHEIM (Helv. Chim. Acta, 1938, 21, 859—862; cf. A., 1938, I, 150).—Mixtures of C<sub>6</sub>H<sub>14</sub> or C<sub>8</sub>H<sub>18</sub> with N<sub>2</sub> and H<sub>2</sub> give better yields of HCN on passage through a high-frequency arc than do CH<sub>4</sub>-N<sub>2</sub>-H<sub>2</sub> mixtures, in accord with the energetics of the reactions. With C<sub>8</sub>H<sub>18</sub> the yield may exceed 60 g. of HCN per kw.-hr. More soot is deposited on the electrodes with the higher homologues, especially with ββ-trimethyl-pentane. The deposit contains only traces of compounds containing H and N, these probably being held by adsorption. J. W. S.

**Photolysis of gaseous hydrogen sulphide.** G. S. FORBES, J. E. CLINE, and B. C. BRADSHAW (J. Amer. Chem. Soc., 1938, 60, 1431—1436).—H<sub>2</sub>S and HBr were photolysed successively, under identical



conditions, using  $\lambda$  208  $\mu$ ., in a rotating quartz cell. Assuming that 1 quantum produces 1 mol. of  $H_2$  from HBr at 400 mm., the quantum yield of  $H_2S$ , referred to that of HBr, is  $1.02 \pm 0.05$  mols. of  $H_2$  per quantum. Systematic errors are cancelled by this comparison. The quantum yield is independent of pressure (8—1400 mm.) and of light flux over a 14-fold range. Correlation of these results with published work indicates that, when  $\alpha$  particles act on  $H_2$ , 4.2 H atoms are produced per ion pair. E. S. H.

**Bromination of acetylene in light of the wavelengths 546 and 436  $\mu$ .** K. L. MÜLLER and H. J. SCHUMACHER (Z. physikal. Chem., 1938, B, 39, 352—370).—The reaction was studied at 60—120°, with  $C_2H_2$  pressures of 15—160 mm., and Br pressures of 15—80 mm. The rate is given by  $d[C_2H_2Br_2]/dt = k[I_{abs.}][C_2H_2][Br_2]/([Br_2] + k')$ . The rate is increased by increasing the total pressure up to 600 mm. by additions of  $N_2$ ,  $CO_2$ , He, or  $C_2H_2Br_2$ . Further increase in total pressure has no influence. The temp. coeff. is slightly  $<1$ , but depends on concn. The quantum yield was  $4 \times 10^4$  mols. per  $h\nu$ . The reaction scheme of Rollefson involving  $Br_3$  mols. is rejected (cf. A., 1935, 48), and a chain mechanism involving Br atoms and  $C_2H_2Br$  radicals is proposed. H. J. E.

**Mercury-photosensitised hydrogenation of ethylene, tetradeuteroethylene, and partially-deuterated ethylenes.** J. C. JUNGERS and H. S. TAYLOR (J. Chem. Physics, 1938, 6, 325—330; cf. A., 1929, 665).—The hydrogenation of  $C_2H_4$ , 95%  $C_2D_4$ , and partly-deuterated ethylene (principally *cis*- and *trans*-CHD:CHD, with small amounts of  $CH_2:CD_2$ ,  $C_2H_3D$ , and  $C_2HD_3$ ) photosensitised by excited Hg ( $\lambda$  2537 Å) has been studied. Under similar conditions  $C_2D_4$  is hydrogenated more rapidly than  $C_2H_4$ , and for both the rate of hydrogenation is independent of the  $C_2H_4$  or  $C_2D_4$  pressure, provided excess of  $H_2$  is present. Both give predominantly  $C_4H_{10}$  with traces of  $C_3H_8$  (more abundant for  $C_2D_4$  than for  $C_2H_4$ ) and negligible amounts of  $CH_4$ . Possible mechanisms are discussed and that involving the reactions (1)  $H + C_2H_4 = C_2H_5$ , (2)  $C_2H_5 + C_2H_5 = C_4H_{10}$ , and, to a smaller extent, (3)  $C_2H_5 + C_2H_5 = C_3H_8 + C_2H_4$  is favoured. When  $[H_2]$  is low or when  $H_2$  is absent, photosensitised polymerisation occurs. This is slower for  $C_2D_4$  than for  $C_2H_4$ , presumably on account of differences in the zero-point energies causing differences in the rates of reaction between these mols. and the free radicals formed. W. R. A.

**Photochemical formation of carbonyl chloride.** X. Chlorine-sensitised formation of carbon dioxide at pressures of 100 to 10 mm. of Hg. W. FRANKE and H. J. SCHUMACHER. XI. Calculation of constants of the component reactions from a consideration of the thermal formation and decomposition of carbonyl chloride. M. BODENSTEIN, W. BRENSCHEDE, and H. J. SCHUMACHER (Z. physikal. Chem., 1938, B, 40, 115—120, 121—134; cf. A., 1937, I, 318).—X. At total pressures of 100 to 10 mm. Hg, as at 0.5—1 atm., the rate of formation of  $CO_2$  at  $32^\circ \approx [CO]^{\frac{1}{2}}$ . At 26.1 mm. total pressure the quantum yield for the formation

of  $CO_2$  is 180 mols. per  $h\nu$ . The val. at 0.5 atm. is 1000 mols. per  $h\nu$ .

XI. Equations are given for the temp.-dependence of the equilibrium  $CO + Cl + M \rightleftharpoons COCl + M$ , and of the reactions  $COCl + Cl_2 = COCl_2 + Cl$ ,  $COCl_2 + Cl = COCl + Cl_2$ , and  $COCl + Cl = CO + Cl_2$ . H. J. E.

**Chemical activity of gas ions. Decomposition of azomethane under the influence of X-rays.** P. GÜNTHER and H. THEOBALD (Z. physikal. Chem., 1938, B, 40, 1—35).— $Me_2N_2$  mixed with Xe is decomposed by X-rays filtered through 5 mm. of Al. No decomp. occurs in absence of Xe. Over a wide range of pressure and mixture composition mols. of  $Me_2N_2$  are decomposed per ion pair. The ion yield falls if the ratio of Xe to  $Me_2N_2$  exceeds 2.5:1. The reaction was studied with Xe and  $Me_2N_2$  pressures of 100—500 mm. and 10—240 mm., respectively, the amount of decomp. being deduced from the  $N_2$  formed. The results cannot be satisfactorily explained on the cluster theory. From the vals. of the dielectric consts. of the two gases, clusters are shown to consist almost entirely of  $Me_2N_2$  mols., even at the  $[Me_2N_2]$  at which the yield per ion pair falls. H. J. E.

**Determination of the nature of accessory products present in small quantities in the products of a reaction by kinetic measurements.** S. C. J. OLIVIER (Rec. trav. chim., 1938, 57, 741—746).—The nature of the different accessory products formed during the chlorination of PhMe at the b.p. under different sources of illumination has been determined by kinetic measurements. W. R. A.

**Photochemical interaction between ketones and secondary alcohols.** C. WEIZMANN, Y. HIRSHBERG, and E. BERGMANN (Nature, 1938, 141, 1012—1013).—The primary photochemical process is probably the activation of the CO compound which reacts with the alcohol, splitting the C-H linking, and giving two free radicals which can dimerise symmetrically or asymmetrically, or be stabilised by a second oxidation-reduction process. L. S. T.

**Photochemical polymerisation of chloroprene and some related molecules.** J. L. BOLLAND and H. W. MELVILLE (Rubber Tech. Conf., 1938, Preprint 90, 10 pp.).—On irradiating chloroprene (I) vapour with light of  $\lambda$  2537 Å, a long induction period is followed by a photo-polymerisation accompanied by visible deposition of polymeride; after prolonged illumination, a "dark" polymerisation sets in. The photo-polymerisation (which is a true polymerisation, the quantum yield being 7) occurs in the condensed stage, the (I) therefore diffusing through the polymeride before it reaches the reaction zone. The "dark" polymerisation also takes place in the condensed phase. Co-polymerisation may involve polymerides which will "grow" in the dark after illumination or those which live only for a short period. (I) will "grow" by polymerisation on a layer of polymerised  $CH_2=CMe-CO_2Me$  without illumination, but butadiene (II) will not. (II) shows no great tendency to photo-polymerisation and reacts with the acrylate polymeride without co-polymerisation. D. F. T.



**Decomposition and synthesis of hydrogen iodide by  $\alpha$ -particles.** K. G. BRATTAIN (*J. Physical Chem.*, 1938, **42**, 617—628).—Vals. obtained for the no. of mols. decomposed per ion pair when HI at 212—806 mm. and 25—200° was irradiated with  $\alpha$ -particles are slightly < those recorded by Vandamme (A., 1933, 238), but both series can be explained by supposing that  $\leq 6$  mols. of HI are decomposed per HI ion pair. A mechanism of the reaction is suggested. The combination of  $H_2$  and  $I_2$  can be explained by supposing that  $\leq 6$  mols. of HI are formed per  $H_2$  ion pair, and 1 mol. of HI per seven  $I_2$  ion pairs, whilst 4 mols. of HI are decomposed per HI ion pair. Experiments at low  $[I_2]$  indicate that either appreciable back reaction occurs, or not all  $H_2$  ion pairs are used in synthesis.

J. W. S.

**Molecular rearrangement induced by ultrasonic waves.** C. W. PORTER and L. YOUNG (*J. Amer. Chem. Soc.*, 1938, **60**, 1497—1500).—The rates of decomp. of  $BzN_3$  in  $C_6H_6$  and in  $NH_2Ph$  at 25° have been determined with and without the application of ultrasonic waves. The rate is accelerated greatly by ultrasonic waves.

E. S. H.

**Constitution of heavy water.** I. R. RAO and P. KOTESWARAM (*Indian J. Physics*, 1938, **12**, 63—74).—Work previously recorded (A., 1938, I, 228) is described in greater detail.

T. H. G.

**Production of large single crystals of potassium bromide suitable for optical use.** D. C. STOCKBARGER (*J. Opt. Soc. Amer.*, 1937, **27**, 416—419).—Crushed KBr is placed in a Pt crucible supported in alundum cement which is lowered through a high temp. gradient at the rate of 1 mm. per hr. At the termination of crystallisation the crucible is inverted and the temp. raised so that the crystal commences to melt; the crucible is removed and the crystal cooled to room temp. Crystals 5 cm. in diameter and 7 cm. long were produced.

F. J. L.

**Determination of the excess oxygen content of the cuprous oxide phase.** C. WAGNER and H. HAMMEN (*Z. physikal. Chem.*, 1938, **B**, **40**, 197—206).—Specimens of  $Cu_2O$  were heated at 900° and 1000° in  $O_2$  at 0.73—33 mm. pressure, quenched in  $H_2O$  at 0°, dissolved in HCl, and the  $Cu^{II}$  determined electrometrically by titration with aq.  $CrSO_4$ . The  $Cu^{II}$  varied from  $1.14 \times 10^{-3}$  g.-atom per g.-atom of  $Cu^I + Cu^{II}$  at 1000° and 33 mm.  $O_2$  pressure to  $0.30 \times 10^{-3}$  (900°/0.73 mm.). The O excess increases with increasing  $O_2$  pressure more rapidly than does the conductivity of the  $Cu_2O$ . The absorption of  $O_2$  is discussed in terms of lattice defects and of association in the solid phase.

H. J. E.

**Amorphous and crystallised oxide hydrates and oxides. XLII. Catalase and peroxidase properties of cupric hydroxide and cupric oxide.** A. KRAUSE [with F. KOPCZYŃSKI and J. RAJEWSKI] (*Ber.*, 1938, **71**, [B], 1229—1234).— $Cu(OH)_2$  is obtained by the action of a slight excess of NaOH on  $CuSO_4$  followed by desiccation in air or in a vac. over NaOH at room temp.; it contains about 25%  $H_2O$ .  $Cu^{II}$  oxide (I) obtained by gradual addition of  $CuSO_4$  to boiling NaOH contains, when air-dried,

about 4.3%  $H_2O$ . Further  $CuO$  with 0.9%  $H_2O$  and anhyd. ignited  $CuO$  (II) are used.  $Cu(OH)_2$  causes a much more rapid decomp. of  $H_2O_2$  than does (I), whereas (II) is almost without action.  $Cu^{II}$  is nearly ineffective; hence this is a case of pronounced heterogeneous catalysis caused by the OH groups (or their H atoms) present in the solid catalyst. OH ions accelerate and H ions retard the decomp. Evidence in favour of the intermediate production of Cu peroxide is adduced. Oxidation of  $HCO_2H$  by  $H_2O_2$  proceeds more rapidly in the presence of (I) than in that of  $Cu(OH)_2$  but the best results are obtained with a defined  $H_2O$  content.  $H_3PO_3$  and  $As_2O_3$  have pronounced restrictive action but the catalyst appears to recover in course of time.

H. W.

**Amorphous and crystallised oxide hydrates and oxides. XLIII. Magnesium hydroxide as strengthening agent for the peroxidising properties of amorphous ferric hydroxide catalysts. Rate of oxidation of formic acid by hydrogen peroxide at 20°.** A. KRAUSE and A. SOBOTA (*Ber.*, 1938, **71**, [B], 1296—1302).—Although a mechanical mixture of  $Mg(OH)_2$  and orthoferric hydroxide (I) has no greater peroxidising action than (I) alone, the product of their co-pptn. is remarkably active, 2.1% of  $MgO$  having a marked action. The products are amorphous. Since Mg ions have no influence the catalysis is heterogeneous. The strengthening is proper to the solid state and is lost when  $Mg(OH)_2$  is dissolved from the solid phase. The highly active condition is attributed to the penetration of the  $Mg(OH)_2$  mols. into the closely packed mol. of (I) whereby the inner surface of solid (I) is appreciably enlarged. Active spots are thus disclosed and, in addition, the already active H atoms acquire increased activation owing to the proximity of the  $Mg(OH)_2$  mols.

H. W.

**Basic calcium salts. II.** F. W. KLINGSTEDT (*Acta Acad. Aboensis math. phys.*, 1936, **9**, pp. 26; *Chem. Zentr.*, 1936, ii, 1873).—The following basic salts have been obtained by heating solutions of the neutral salts with  $CaO$ :  $3Ca(OH)_2, CaCl_2, 12H_2O$ ;  $3Ca(OH)_2, CaBr_2, 12H_2O$ ;  $3Ca(OH)_2, CaI_2, 12H_2O$ ;  $3Ca(OH)_2, Ca(CNS)_2, 9.5H_2O$ ;  $3Ca(OH)_2, Ca(ClO_4)_2, 12H_2O$ ; and  $3Ca(OH)_2, Ca(MnO_4)_2, 12H_2O$ .  $Ca(OH)_2, Ca(ClO_4)_2, 2-4H_2O$ ;  $Ca(OH)_2, Ca(NO_3)_2, 2H_2O$ , and  $Ca(OH)_2, Ca(NO_2)_2, 2H_2O$  have also been prepared.

L. S. T.

**Influence of preparation of zinc oxide on its reduction by hydrogen.** F. SCHACHERL (*Publ. Fac. Sci. Univ. Masaryk*, 1938, No. 255, 3—13).—The equilibrium const. of the reduction is high for ZnO prepared in an electric arc, lower for ZnO prepared by igniting  $ZnCO_3$  at 350°, and still lower for that prepared by ignition at  $>1000^\circ$ . Samples prepared at low temp. are stated to have a higher energy content owing to irregularities of crystal structure, whilst those prepared in an electric arc have a large surface energy.

E. S. H.

**Active oxides and reactions of solid substances. CX. Systems zinc oxide-ferric oxide and beryll-**



**ium oxide-ferric oxide.** G. F. HÜTTIG [with R. GEISLER, J. HAMPPEL, O. HNEVCOVSKY, F. JEITNER, H. KITTEL, O. KOSTELITZ, F. OWESNY, H. SCHMEISER, O. SCHNEIDER, and W. SEDLATSCHKE, (Z. anorg. Chem., 1938, 237, 209—325).—The changes occurring when ZnO and Fe<sub>2</sub>O<sub>3</sub> are heated together in varying proportions and at different temp. have been studied by means of X-rays, measurements of  $\chi$ , and studies of the sorption of MeOH vapour and of dissolved dyes, and of the catalytic activity for certain gas reactions. Parallel measurements were carried out with the single components and with BeO-Fe<sub>2</sub>O<sub>3</sub> mixtures, and the results are correlated with the scheme of intermediate stages put forward by Hüttig *et al.* (A., 1936, 1216). F. J. G.

**X-Ray studies on the hydrous oxides. IX. Scandium oxide monohydrate.** W. B. WEISER and W. O. MILLIGAN (J. Physical Chem., 1938, 42, 669—672; cf. A., 1937, I, 575).—Addition of alkalis to solutions of Sc salts at 25° or 100° yields a white ppt. of Sc<sub>2</sub>O<sub>3</sub>·H<sub>2</sub>O, with crystal structure similar to that of  $\gamma$ -Al<sub>2</sub>O<sub>3</sub>·H<sub>2</sub>O and distinct from that of Sc<sub>2</sub>O<sub>3</sub>. Dehydration isobars for this compound have been obtained. No evidence could be obtained for the existence of any second form of anhyd. Sc<sub>2</sub>O<sub>3</sub> at 450—900°. The alleged 2Sc(OH)<sub>3</sub>·H<sub>2</sub>O (A., 1935, 714) is probably hydrous Sc<sub>2</sub>O<sub>3</sub>·H<sub>2</sub>O. J. W. S.

**Hydrous oxides of some rarer elements.** H. B. WEISER and W. O. MILLIGAN (J. Physical Chem., 1938, 42, 673—678; cf. A., 1937, I, 575).—The dehydration isobars and X-ray diffraction patterns of the oxides pptd. under various conditions have been investigated. Those of In, Nd, and Pr comprise hydrous trihydrates or hydroxides, and those of Ga (formed slowly or aged) and Sc are hydrous monohydrates, whilst those of Tl, Ga (formed rapidly or unaged), Y, and Sm are hydrous oxides. J. W. S.

**Preparation of pure terbium oxide.** W. PRANDT (Z. anorg. Chem., 1938, 238, 65—68).—The separation of Tb from Dy and Gd by fractional crystallisation of the NH<sub>4</sub> double oxalates is described. The brown oxide (composition not stated), obtained by ignition, is only slowly attacked by HNO<sub>3</sub>, with evolution of O<sub>2</sub>, or by HCl, with evolution of O<sub>2</sub> and Cl<sub>2</sub>. E. S. H.

**Reactions of solid carbon with gases and liquids.** O. RUFF (Z. Elektrochem., 1938, 44, 333—341).—A lecture. Modern concepts of the structure of C and its reactions at various temp. with O<sub>2</sub>, CO<sub>2</sub>, F<sub>2</sub>, and metals are discussed. C. R. H.

**Pentacarbon dioxide.** O. DIELS (Ber., 1938, 71, [B], 1197—1200).—The possibility of the existence of C<sub>5</sub>O<sub>2</sub> is not denied but the properties of the compound described by Klemenc *et al.* (A., 1937, I, 575) are not those to be expected for such a substance. H. W.

**Graphite salts.** W. RÜDORFF and U. HOFMANN (Z. anorg. Chem., 1938, 238, 1—50).—Salts of graphite can be prepared by oxidation of graphite in conc. H<sub>2</sub>SO<sub>4</sub>, HNO<sub>3</sub>, HClO<sub>4</sub>, H<sub>2</sub>SeO<sub>4</sub>, H<sub>3</sub>PO<sub>4</sub>, H<sub>2</sub>P<sub>4</sub>O<sub>7</sub>, or molten As<sub>2</sub>O<sub>5</sub> + CrO<sub>3</sub>. The salts are stable only in the conc. acids; they are decomposed by H<sub>2</sub>O or org. liquids. With each salt, several steps of oxidation

have been recognised, the highest degree of oxidation with H<sub>2</sub>SO<sub>4</sub>, HNO<sub>3</sub>, and HClO<sub>4</sub> giving blue compounds. X-Ray investigation shows that the hexagonal planes of graphite are retained; the distance is increased from 3.34 Å. to 7.98 Å. for the H<sub>2</sub>SO<sub>4</sub> compound, 7.94 Å. for the HClO<sub>4</sub> compound, 7.84 Å. for the HNO<sub>3</sub> compound, and 8.25 Å. for the H<sub>2</sub>SeO<sub>4</sub> compound. The formula determined for the blue compound with H<sub>2</sub>SO<sub>4</sub> is C<sub>24</sub><sup>+</sup>·HSO<sub>4</sub><sup>-</sup>·2H<sub>2</sub>SO<sub>4</sub>; its structure is discussed. The acid mol. and radical can be exchanged reversibly with HClO<sub>4</sub>, HNO<sub>3</sub>, or H<sub>2</sub>SeO<sub>4</sub> by treatment with the requisite acid. E. S. H.

**New types of silicon compounds.** R. SCHWARZ (Angew. Chem., 1938, 51, 328—331).—An account of previously published work (A., 1937, I, 372; 1938, I, 208) is given. By heating Si<sub>10</sub>Cl<sub>20</sub>H<sub>2</sub> in a stream of CO<sub>2</sub> at 260—300° a yellow amorphous compound (SiCl)<sub>x</sub> is obtained. It is insol. in org. solvents, decomposed by H<sub>2</sub>O, and by heating above 400°. It ignites in O<sub>2</sub> at 98° and gives an explosive product with HNO<sub>3</sub>. The pyrolysis of Si<sub>10</sub>Cl<sub>20</sub>H<sub>2</sub> is complex and yields, in addition to the (SiCl)<sub>x</sub>, HCl and a mixture of volatile compounds. F. L. U.

**Affinity. LXXXI. Thorium phosphide.** E. F. STROTZER and W. BILTZ [with K. MEISEL] (Z. anorg. Chem., 1938, 238, 69—80).—The prep. of Th<sub>3</sub>P<sub>4</sub>, by the action of P vapour on Th at 650—700° in a sealed tube, is described. Th<sub>3</sub>P<sub>4</sub> has  $d_{25}^{25}$  8.44; it is unchanged by cold H<sub>2</sub>O, but attacked by dil. acids with evolution of PH<sub>3</sub>; it is stable to heating at 1100°. X-Ray examination shows evidence of the existence of a subphosphide. E. S. H.

**Autoxidation of metallic antimony.** P. WULFF, L. ZELLER, and E. BUHE (Z. Elektrochem., 1938, 44, 360—366).—The autoxidation of Sb in solutions of widely differing  $p_H$  vals., and at various temp. and partial pressures of O<sub>2</sub>, is rapid at first but the oxidation product forms a protective layer which influences further oxidation and the stabilising of p.d. vals. In the presence of alkali or of substances which react with Sb, the oxidation of Sb continues after the initial rapid autoxidation but at a much reduced rate. The formation of the protective layer which is insol. in the solutions, and the subsequent oxidation, presumably to Sb<sub>2</sub>O<sub>5</sub>, which may react with the solution and dissolve, are regarded as distinct stages. C. R. H.

**Affinity. LXXIX. System niobium-sulphur.** W. BILTZ and A. KÖCHER (Z. anorg. Chem., 1938, 237, 369—380).—The system Nb-S has been investigated by means of X-rays and tensimeter curves. There are a *sesquisulphide*, Nb<sub>2</sub>S<sub>3</sub>, which forms solid solutions with S up to approx. NbS<sub>4</sub>, and a *monosulphide*, NbS, which forms solid solutions with Nb up to approx. Nb<sub>2</sub>S. The increment of mol. vol. for S in the lower sulphides is 11, corresponding with semimetallic binding; in the higher sulphides it is 15, corresponding with free S. F. J. G.

**Affinity. LXXXII. System tantalum-sulphur.** W. BILTZ and A. KÖCHER (Z. anorg. Chem., 1938, 238, 81—93).—Tensimetric analysis and X-ray examination show the existence of TaS<sub>3</sub>, TaS<sub>2</sub>, and a subsulphide (TaS<sub>1.1</sub>). TaS<sub>3</sub> has  $d_{25}^{25}$  5.72 and sublimes



readily;  $TaS_2$  has  $d_4^{25}$  6.86 and does not sublime at  $1000^\circ$ . The sulphides are stable in air and changed little by dil. HCl. Resistance to conc. HCl, conc.  $H_2SO_4$ , aq. Br, or  $H_2O_2$  is in the order  $TaS_3 > TaS_2 > TaS_{1.1}$ ; resistance to warm aq. NaOH is in the reverse order.

E. S. H.

**Genesis and properties of oxides.** N. PARRAVANO (*Chim. e l'Ind.*, 1938, 20, 1—7).—A lecture.

O. J. W.

**Analysis of chromium nitride.** H. TER MEULEN (*Rec. trav. chim.*, 1938, 57, 591—593).— $Cr_3N$  is a dark green amorphous powder extremely resistant to acids. Fusion with  $Na_2CO_3$  and  $KNO_3$  converts the Cr into  $CrO_4^{2-}$ ; this is then reduced by  $SO_2$ , pptd. by aq.  $NH_3$ , and weighed as  $Cr_2O_3$ . To determine N, about 0.1 g. of  $Cr_3N$  and about 1.0 g. of  $Na_2O_2$  were placed in a Pt boat in a quartz tube through which  $O_2$  was passed. On heating,  $N_2$  was liberated. The gases issuing from the quartz tube were collected and analysed. The analyses correspond closely with the formula  $Cr_3N$ .

W. R. A.

**Thermal decomposition of ammonium dichromate.** E. H. HARBARD and A. KING (*J.C.S.*, 1938, 955—957).—The black product obtained by heating  $(NH_4)_2Cr_2O_7$  at a temp. below its normal decomp. temp. is probably a solid solution of two or more compounds. On further heating, an olive-green oxide is formed which contains rather more O than is required by  $Cr_2O_3$ . Since this excess is not easily reduced, the compound is regarded as a non-stoichiometric oxide.

C. R. H.

**Peroxy-compounds. III. State of solution of peroxytungstates (measurement of  $[H^+]$  of solutions of sodium tungstate containing hydrogen peroxide).** K. F. JAHR and E. LOTHER (*Ber.*, 1938, 71, [B], 1127—1142).—Mono- and hexatungstate solutions differ in their behaviour towards addition of  $H_2O_2$ , the former becoming more alkaline, the latter more acidic. Solutions containing 2 mols. of  $H_2O_2$  and 1 mol. of  $Na_2WO_4$  are colourless and have a max.  $p_H$  immediately after their prep. With increasing  $H_2O_2$  content the solutions become increasingly yellow and less alkaline. The  $p_H$  of solutions of hexatungstate diminishes very rapidly on addition of small amounts of  $H_2O_2$ . With  $>12$  mols. of  $H_2O_2$  per mol. of  $Na_5(HW_6O_{21})$ ,  $p_H$  diminishes only slowly; the solutions are colourless. In  $Na_2WO_4$  solutions poor in  $H_2O_2$  the reaction is mainly  $[WO_4]^{2-} + 2H_2O_2 \rightleftharpoons [HWO_6]^- + OH^- + H_2O$ . With a larger excess of  $H_2O_2$  the yellow ions of tetraperoxytungstic acid are preferably formed whereby a marked change of  $[H^+]$  is not occasioned:  $[WO_4]^{2-} + 4H_2O_2 \rightleftharpoons [WO_8]^{2-} + 4H_2O$ . In hexatungstate solutions the main change is the formation of the colourless hydrogenperoxytungstic acid (I); the hexatungstate ions are decomposed with liberation of H ions:  $[HW_6O_{21}]^{5-} + 12H_2O_2 \rightleftharpoons 6[HWO_6]^- + 9H_2O + H^+$ . Addition of acid quantitatively converts monotungstate ions in presence of excess of  $H_2O_2$  into the ions of (I), as shown by the sudden diminution of  $p_H$  after addition of 1 equiv. of  $HClO_4$  to 1 mol. of  $Na_2WO_4$ . The position of this break does not alter with the concn. of the  $H_2O_2$  if this exceeds 2 mols. per mol. of  $Na_2WO_4$ . If this mol. relationship is not attained  $HClO_4$  equiv.

to half the amount of  $H_2O_2$  must be added before the break occurs. In tungstate solutions poor in  $H_2O_2$  increased addition of acid yields successively different yellow peroxytungstic acids which have not been fully characterised. These are formed also in the course of the natural "ageing" of peroxytungstate solutions which occurs with loss of active O and is caused by the catalytic decomp. of  $H_2O_2$  accelerated by tungstic acid. The peroxytungstic acids and the different peroxypolytungstic acids (which exist in the increasingly acidic, decreasingly peroxidic, tungstate solutions) behave as intermediates in the course of this catalytic decomp. These peroxypolytungstic acids differ from one another very appreciably in their rates of decomp.

H. W.

**Theory of mineral tannage. IX. Behaviour of polytungstate solutions on ageing.** A. KÜNTZEL, C. RIESS, and H. ERDMANN (*Collegium*, 1938, 257—272; cf. *B.*, 1937, 68).—Acidified tungstate solutions polymerise to form negatively charged aggregates having tanning properties, and resembling basic Cr solutions in some properties. A titration curve of 0.1N-Na tungstate with HCl, and back-titration curves with NaOH, both immediately and after 24 hr., have been obtained. The back-titration curves are less acid than the original. HCl has been added to 0.1N- and N-Na tungstate, respectively, in varying proportions up to 2 mols. of HCl per mol. of Na tungstate, and the  $p_H$  of each solution determined immediately, after various time intervals up to 8 days, and after subsequently boiling. With increasing proportion of acid up to 1.4 mols. of HCl per mol. of Na tungstate the aged boiled solution is increasingly less acid than the freshly prepared HCl-tungstate solution. At acid : tungstate mol. ratios 1.5—1.6 the  $p_H$ -time curve follows an irregular course.  $H_2O$  is eliminated in the polymerisation of tungstate solutions in a manner similar to that involved in theolation of basic Cr solutions. The ageing of tungstate solutions differs from that of basic Cr solutions in that hydrolysis of tungstate solutions is small, the  $p_H$  of boiled HCl-tungstate solution does not alter further on ageing cold, and the tungstate polymerises to form different compounds, the mol. wts. of which are in some simple stoichiometrical relation to one another, whereas basic Cr salts polymerise to form compounds of the same structure but varying mol. wt.

D. P.

**Manganese perchlorate and per-rhenate.** J. G. F. DRUCE (*J.C.S.*, 1938, 966).— $Mn(ClO_4)_2 \cdot 6H_2O$  can be obtained by dissolving  $MnCO_3$  in  $HClO_4$  and concentrating the clear filtrate over anhyd.  $Mg(ClO_4)_2$ . The anhyd. salt cannot be prepared pure.  $Mn(ReO_4)_2 \cdot 3H_2O$  and the anhyd. salt can be similarly prepared from  $HReO_4$ .  $Mn(ReO_4)_2$  does not melt below  $300^\circ$  but at higher temp.  $Re_2O_7$  and  $Mn_3O_4$  are formed.

C. R. H.

**Preparation of iron by reduction with hydrogen.** P. M. ZAVELEVITSCH (*Sborn. Rabot Lab. Inst.*, 1937, 15, 51—57).—The prep. of finely divided Fe, suitable for pharmaceutical and analytical work, by reducing  $Fe_2O_3$  is described. The latter is best prepared from  $Fe(OH)_3$  which is obtained by pptn. of  $Fe(NO_3)_3$  with aq.  $NH_3$ . The optimum reduction temp. is  $700^\circ$ ; the time required to reduce 20 g. of



oxide, including the heating-up period from 400° to 700°, is 1 hr.; the quantity of H<sub>2</sub> required is 4.5 times the theoretical. After reduction the product should be cooled in a current of H<sub>2</sub> to 400° and not to 60–80°, which is usually recommended. D. G.

**Behaviour of ferric and thorium hydroxides, as a function of the pretreatment and preparation, studied by the Otto Hahn emanation method.** H. GÖTTE (Z. physikal. Chem., 1938, B, 40, 207–230).—Rapidly pptd. Fe(OH)<sub>3</sub> shows a rapid increase in emanation loss at 850°, followed by a min. at 1000°. Slowly pptd. material does not show this effect, but it can be induced by ageing in H<sub>2</sub>O at 100° for 12 hr. or by heating at 600° in a moist atm. For Th(OH)<sub>4</sub> there was little difference between emanation loss-temp. curves for material pptd. slowly or rapidly. Th(OH)<sub>4</sub> aged in hot H<sub>2</sub>O showed a much greater loss at 100–1000° than unaged material. When heated in a moist gas stream it gave a max. at 850°. Ageing under H<sub>2</sub>O causes crystallites to form in Th(OH)<sub>4</sub>. These form larger crystals at >700°. This behaviour was confirmed by X-ray observations. The emanation loss from active Zn(OH)<sub>2</sub> is increased by dilution with an amorphous material, e.g., Fe(OH)<sub>3</sub>. In general the presence of cryst. material diminishes the emanation loss.

H. J. E.

**Reversible reaction between a complex metal-amine ion and hydrogen ions.** G. A. BARBIERI and C. FERRARI (Ric. sci. Progr. tech., 1936, [ii], 7, 390–391; Chem. Zentr., 1936, ii, 1834).—Contrary to the general case, the cation of the Fe dipyriddy compounds can react according to  $[\text{Fe}(\text{dipy})_3]^{3+} + 6\text{H}^+ \rightleftharpoons \text{Fe}^{3+} + 3[\text{dipyH}_2]$ . The same equilibrium is reached with H<sub>2</sub>SO<sub>4</sub> solutions of FeSO<sub>4</sub> as with acids. At 90° equilibrium is quickly reached and is thrown to the right, but on cooling the normal equilibrium colour returns. L. S. T.

**Dehydration of cobalt sulphate heptahydrate.** R. ROHMER (Compt. rend., 1938, 206, 1573–1575).—In contact with aq. H<sub>2</sub>SO<sub>4</sub> of suitable concn., CoSO<sub>4</sub>·7H<sub>2</sub>O is progressively dehydrated to hydrates containing 6, 4, 2, and 1H<sub>2</sub>O (cf. A., 1934, 1187) and to the anhyd. salt. The rate of dehydration increases with temp. and [H<sub>2</sub>SO<sub>4</sub>]. A. J. E. W.

**Stereoisomerism of cobaltitrinitrotriammines.** (MME.) R. DUVAL (Compt. rend., 1938, 206, 1652–1654).—Two distinct X-ray powder diagrams have been obtained with specimens of [Co(NO<sub>2</sub>)<sub>3</sub>(NH<sub>3</sub>)<sub>3</sub>] prepared by different methods, indicating the existence of stereoisomerides in the solid state. Vals. of  $n$  and  $\Lambda$  for the aq. solutions, and their absorption spectra, are identical. A. J. E. W.

**$\alpha$ -Form of the hydroxides of bivalent metals.** W. FEITKNECHT (Helv. Chim. Acta, 1938, 21, 766–784).—Co(OH)<sub>2</sub>, Zn(OH)<sub>2</sub>, and Cd(OH)<sub>2</sub>, freshly pptd. by NaOH ( $\alpha$ -forms), yield closely similar X-ray diagrams, with only  $hk0$ - and weak broad  $001$ -patterns. From these measurements and from the chemical behaviour it is inferred that the forms comprise ordered layers of structure similar to those of the  $C6$ -forms, separated by intermediate layers of disordered hydroxide mols. There are 4 mols. in the

ordered state to one in the disordered state, the metal atom of the latter being probably bound by homopolar linkages, thus accounting for the blue colour of  $\alpha$ -Co(OH)<sub>2</sub> as compared with the rose colour of the  $C6$ -form. Half of the OH' in the disordered layer can be replaced by Cl'.  $\alpha$ -Co(OH)<sub>2</sub> can be stabilised by polyhydric alcohols or sugar, probably owing to their being strongly adsorbed.  $\alpha$ -Zn(OH)<sub>2</sub> is capable of existence only when part of the OH' is replaced by anions. When the latter are eliminated the ordered layers also lose their arrangement, yielding amorphous Zn(OH)<sub>2</sub>. The  $\alpha$ -form has not yet been obtained with Ni(OH)<sub>2</sub>. Mixed hydroxides of Zn with Ni and Co have similar structure to the  $\alpha$ -forms of the pure hydroxides. The intermediate layer in the former comprises Zn(OH)<sub>2</sub>, whilst that of the latter is initially Co(OH)<sub>2</sub>, but on ageing this is replaced by Zn(OH)<sub>2</sub>, a colour change occurring from blue to rose. J. W. S.

**Dehydration of nickel and potassium nickel sulphates.** (MME.) N. DEMASIEUX and B. FEDEROFF (Compt. rend., 1938, 206, 1649–1651).—The dehydration by heating of NiSO<sub>4</sub>·7H<sub>2</sub>O (I) and K<sub>2</sub>SO<sub>4</sub>·NiSO<sub>4</sub>·6H<sub>2</sub>O (II) has been studied; X-ray diagrams illustrating the process are given. (I) begins to lose H<sub>2</sub>O at room temp., giving successively NiSO<sub>4</sub>·6H<sub>2</sub>O (stable up to 85°), NiSO<sub>4</sub>·4H<sub>2</sub>O (stable at >250°), and NiSO<sub>4</sub> above 350°. NiSO<sub>4</sub> gives NiSO<sub>4</sub>·6H<sub>2</sub>O on exposure to the atm. (II) loses H<sub>2</sub>O at >105°, and dehydration is complete at 250°; (II) is re-formed on exposure. During dehydration a salt may exist in a state giving no X-ray diagram (cf. A., 1937, I, 119). A. J. E. W.

**Ruthenium amines. VIII. Praseo-salts. Dichloro-series. IX. Violeo-salts. Dichloro-series. X. Violeo-salts. Dibromo-series.** K. GLEU and W. BREUEL (Z. anorg. Chem., 1938, 237, 326–334, 335–349, 350–358).—VIII. When [Ru<sup>II</sup>(NH<sub>3</sub>)<sub>4</sub>(SO<sub>2</sub>)Br]Br is oxidised with Br, trans-dibromotetramminoruthenium<sup>III</sup> perbromide, [Ru<sup>III</sup>(NH<sub>3</sub>)<sub>4</sub>Br<sub>2</sub>]Br<sub>2</sub> is pptd., and from it by double decomp. other bromo-praseo-salts may be obtained, viz.: [Ru(NH<sub>3</sub>)<sub>4</sub>Br<sub>2</sub>]Br·H<sub>2</sub>O, (I) also anhyd.; [Ru(NH<sub>3</sub>)<sub>4</sub>Br<sub>2</sub>]Cl<sub>2</sub>·H<sub>2</sub>O; [Ru(NH<sub>3</sub>)<sub>4</sub>Br<sub>2</sub>]NO<sub>3</sub>; [Ru(NH<sub>3</sub>)<sub>4</sub>Br<sub>2</sub>]SO<sub>4</sub>·H<sub>2</sub>O; [Ru(NH<sub>3</sub>)<sub>4</sub>Br<sub>2</sub>]SO<sub>4</sub>Ag; [Ru(NH<sub>3</sub>)<sub>4</sub>Br<sub>2</sub>]SO<sub>4</sub>; [Ru(NH<sub>3</sub>)<sub>4</sub>Br<sub>2</sub>]S<sub>2</sub>O<sub>6</sub>. They are deep red or brown and very stable to acids. The Br is more firmly bound than in the corresponding Co salts. The trans-configuration follows from the method of prep. (I) is paramagnetic,  $\chi$  4.039 × 10<sup>-6</sup> at 21°, corresponding with a mol. moment of approx. 2 Bohr magnetons.

IX. When [Ru(NH<sub>3</sub>)<sub>5</sub>(OH)]S<sub>2</sub>O<sub>6</sub> is warmed with aq. H<sub>2</sub>C<sub>2</sub>O<sub>4</sub>, oxalatotetramminoruthenium<sup>III</sup> dithionate, [Ru(NH<sub>3</sub>)<sub>4</sub>C<sub>2</sub>O<sub>4</sub>]<sub>2</sub>S<sub>2</sub>O<sub>6</sub> (II), is pptd. It is almost insol., yellow, and paramagnetic,  $\chi$  4.680 × 10<sup>-6</sup> at 20°. When boiled with conc. HCl, (II) affords cis-dichlorotetramminoruthenium<sup>III</sup> chloride, [Ru(NH<sub>3</sub>)<sub>4</sub>Cl<sub>2</sub>]Cl<sub>2</sub>·0.75H<sub>2</sub>O,  $\chi$  5.678 × 10<sup>-6</sup> at 20°. From it other chloro-violeo-salts may be obtained by double decomp., viz., [Ru(NH<sub>3</sub>)<sub>4</sub>Cl<sub>2</sub>]NO<sub>3</sub>; [Ru(NH<sub>3</sub>)<sub>4</sub>Cl<sub>2</sub>]<sub>2</sub>SO<sub>4</sub>·H<sub>2</sub>O, also with 1.5H<sub>2</sub>O; [Ru(NH<sub>3</sub>)<sub>4</sub>Cl<sub>2</sub>]<sub>2</sub>S<sub>2</sub>O<sub>6</sub>. They are yellow, and the  $\chi$ -vals. correspond with a mol. moment of approx.



2 Bohr magnetons. The *cis*-configuration follows from the method of prep. The Cl is more firmly bound than in the corresponding Co salts, but less so than in the *praseo*-Ru salts. A comparison with the dichlorotetrammino-Ir<sup>III</sup> salts indicates that these also have the *cis*-configuration. On prolonged heating with HCl the *violeto*-Ru salts afford *trichlorotriaminoruthenium*, [Ru(NH<sub>3</sub>)<sub>3</sub>Cl<sub>3</sub>], as a sparingly sol. red ppt.

X. By a method similar to that employed for the *cis*-dichloro-salts (cf. preceding abstract) the following *cis-dibromotetramminoruthenium*<sup>III</sup> salts have been obtained: [Ru(NH<sub>3</sub>)<sub>4</sub>Br<sub>2</sub>]Br<sub>2</sub>·0.5H<sub>2</sub>O (III); [Ru(NH<sub>3</sub>)<sub>4</sub>Br<sub>2</sub>]NO<sub>3</sub>; [Ru(NH<sub>3</sub>)<sub>4</sub>Br<sub>2</sub>]SO<sub>4</sub>·H<sub>2</sub>O; [Ru(NH<sub>3</sub>)<sub>4</sub>Br<sub>2</sub>]S<sub>2</sub>O<sub>6</sub>. They are brown or red and paramagnetic; (III) has  $\chi$  3.761 × 10<sup>-6</sup> at 20°, corresponding with a mol. moment of approx. 2 Bohr magnetons. The dihalogenotetrammino-Ru<sup>III</sup> salts prepared by the authors (cf. A., 1938, I, 321, and above) are different from the derivatives of Ru-red described by Morgan and Burstall (A., 1936, 302), and the formulation of the latter compounds as dihalogenotetrammino-salts, and the corresponding formula for Ru-red, are rejected. F. J. G.

**Dithiocarbamates of ruthenium, rhodium, and palladium.** L. MALATESTA (Gazzetta, 1938, 68, 195—198; cf. A., 1937, I, 606).—The compounds M[S·CS·NR<sub>2</sub>]<sub>3</sub> (M = Ru, Rh; R = Me, Et, Bu) and Pd[S·CS·NR<sub>2</sub>]<sub>2</sub> are described. The Ru<sup>III</sup> compounds are paramagnetic with a susceptibility corresponding with one electron spin; the Rh<sup>III</sup> and Pd<sup>II</sup> compounds are diamagnetic. O. J. W.

**Compounds of platinum and carbon monoxide.** A. GELMAN and M. BAUMAN (Compt. rend. Acad. Sci. U.R.S.S., 1938, 18, 645—648; cf. A., 1937, I, 630; II, 282; 1938, I, 43).—CO complexes, less stable than the C<sub>2</sub>H<sub>4</sub> analogues, have been prepared. K[CO PtCl<sub>3</sub>], prepared in solution by the action of CO on K<sub>2</sub>PtCl<sub>4</sub> at room temp., yields with aq. C<sub>5</sub>H<sub>5</sub>N *trans*-[CO(C<sub>5</sub>H<sub>5</sub>N)PtCl<sub>2</sub>] (I), m.p. 127° (decomp.).

The equilibrium (I)  $\xrightleftharpoons[C_5H_5N]{HCl}$  (C<sub>5</sub>H<sub>5</sub>N)H[CO PtCl<sub>3</sub>] is established. The NH<sub>3</sub> analogue of (I) was not obtained. Aq. Koss' (NH<sub>3</sub>) salt yields with CO, at 11—13° only, *cis*-[CO NH<sub>3</sub> PtCl<sub>2</sub>] (II), decomp. at 180°. Properties of (I) and (II) are contrasted. Comparison of CO, C<sub>2</sub>H<sub>4</sub>, NO<sub>2</sub>, and NO complexes with those of NH<sub>3</sub>, NO<sub>3</sub><sup>-</sup>, and halogens emphasises unsaturation (of C, N), not polarisability, as the *trans*-influence. I. MCA.

**Anodic dissolution as a method of microchemical analysis.** A. GLAZUNOV (Österr. Chem.-Ztg., 1938, 41, 217—223; cf. B., 1932, 1121; 1937, 578).—A piece of filter-paper soaked in a suitable reagent is placed between the surface of the specimen to be examined and a metal (Al) cathode. On connecting the specimen to the anode a small amount of the metal passes into solution in the reagent and is identified by the characteristic colour produced. The method has been applied to the study of the macro-structure of alloys, the examination of protective metal coatings, the analysis of minerals, etc. Its further development is dependent on the possi-

bility of discovering sp. org. reagents suitable for the purpose. A. B. M.

**Calculation of corrections for volume of precipitate in titrating with an aliquot part of filtrate.** P. I. ALEXEEV (Sborn. Rabot. Lab. Inst., 1937, 15, 79—90).—Formulae for calculating results of analyses, including corrections for the vol. of ppt., in titrating an aliquot part of a filtrate are given. Examples illustrate the magnitude of the errors due to the vol. of ppt. D. G.

**Quantitative analysis of mixtures of strong and weak acids, buffer and neutral salts, with special reference to leather and tanning extracts.**—See B., 1938, 820, 821.

**p<sub>H</sub> of sea-water as measured with the glass electrode.** E. G. BALL and C. C. STOCK (Biol. Bull. Wood's Hole, 1937, 73, 221—226).—Since the H<sub>2</sub> electrode is unreliable for determining the p<sub>H</sub> of sea-H<sub>2</sub>O it was compared with the glass electrode using buffer solutions to which sea salts in concn. similar to that of sea-H<sub>2</sub>O were added. Approx. the same p<sub>H</sub> vals. were obtained. Hence the glass electrode is suitable for use with sea-H<sub>2</sub>O, giving an accuracy of ±0.03 p<sub>H</sub>. A. D. H.

**Determination of moisture in carnallites by the carbide method.**—See B., 1938, 777.

**Detection and determination of alkali and alkaline-earth chlorides and bromides in presence of the cyanides and thiocyanates.** E. SCHULEK (Z. anal. Chem., 1938, 112, 415—417).—The solution containing approx. 0.5 g. of alkali cyanide, 5—160 mg. of bromide or 3—70 mg. of chloride, excess of NaOH and 30% H<sub>2</sub>O<sub>2</sub> is boiled for 10 min. to convert the CN' into NH<sub>3</sub> and CO<sub>3</sub>''. After cooling, the solution is acidified with HNO<sub>3</sub> and the halogen determined volumetrically by Volhard's method. The method fails for iodide. In presence of CNS' a second treatment with H<sub>2</sub>O<sub>2</sub> is necessary. The CNS' is converted into CO<sub>3</sub>'', SO<sub>4</sub>'', and NH<sub>3</sub>. L. S. T.

**Determination of fluorine in insecticide products.**—See B., 1938, 829.

**Standardisation of thiosulphate solutions by means of copper and cupric sulphate.** H. W. FOOTE (J. Amer. Chem. Soc., 1938, 60, 1349—1350).—The reaction CuSO<sub>4</sub> + 2KI → CuI + I + K<sub>2</sub>SO<sub>4</sub> offers advantages in the standardisation of aq. Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>; it is quant. if NH<sub>4</sub>CNS is added just before the end-point in order to liberate I adsorbed by CuI. The mean deviation from the I standard in 25 determinations was 1 part in 1300. E. S. H.

**Determination of sulphur in steel and ferrous alloys by combustion.**—See B., 1938, 794.

**Determination of sulphur in metals.**—See B., 1938, 797.

**Determination of sulphur in petroleum and lubricating oils.**—See B., 1938, 756.

**Determination of hydrogen sulphide in air.**—See B., 1938, 851.

**Determination of sulphur dioxide, sulphite, etc. in sulphited [vegetable tanning] extracts.**—See B., 1938, 820.



**Determination of sulphur dioxide in presence of nitrogen oxides.**—See B., 1938, 779.

**Simultaneous conductometric titration of sulphuric and nitric acids.** C. J. VAN NIEUWENBURG (Rec. trav. chim., 1938, 57, 616—619).—Reduction of  $[H^+]$  by the addition of excess of an exactly neutral solution of an alkali salt of a moderately strong acid makes it possible to determine conductometrically  $H_2SO_4$  and  $HNO_3$  in the same solution by means of a single titration. A procedure using  $CH_2Cl-CO_2Na$  is described in detail. W. R. A.

**Separation of tellurium from selenium in the analysis of ores.**—See B., 1938, 780.

**Possibility of misinterpreting the results of nitrogen determinations by the micro-Dumas method.** (Miss) H. J. RAVENSWAAY and A. SCHWEIZER (Rec. trav. chim., 1938, 57, 688—693).—N analysis by the micro-Dumas method (I) on humine (a by-product obtained in preparing lævulinic acid by dehydrating sucrose with dil. HCl) revealed presence of up to 2.4% N; no N was found by the Ter Meulen method. Analysis of the gas suspected from (I) to be  $N_2$  indicated that it was  $CH_4$ . High  $N_2$  analyses by (I) are possibly due to the liberation of a gas (e.g.,  $CH_4$ ) by the substance undergoing analysis. The importance of checking results from (I) by either the Ter Meulen or Kjeldahl methods is stressed. W. R. A.

**Micro-determination of nitrogen in steels.**—See B., 1938, 794.

**Assay of nitrogen monoxide.**—See B., 1938, 779.

[Colorimetric determination of ammonia, nitrite, lead, and cadmium in air.]—See B., 1938, 851.

**Coulometric analysis as precision methods. IV—VII.** L. SZEBELLÉDY and Z. SOMOGYI (Z. anal. Chem., 1938, 112, 385—390, 391—395, 395—399, 400—404; cf. A., 1938, I, 368).—IV. Optimum conditions and details of procedure for the determination of HCNS by oxidation with Br liberated from KBr by electrolysis in 5—10% HCl solution at 0—5° are given. The Br consumed by the HCNS + the slight excess in the electrolyte solution (determined by means of KI and 0.01N- $Na_2S_2O_3$ ) is found from the wt. of Ag deposited in a coulometer.

V. Details are given for the determination of  $N_2H_4$  utilising the reaction  $N_2H_4 + 2Br_2 = 4HBr + N_2$  by a procedure similar to that given above. Electrolysis is carried out in 10—20% HCl solution at 60—65°. The method gives results in agreement with the bromate method of Kurtenacker *et al.* (A., 1924, ii, 778).

VI. The method described for the determination of NaOH involves the electrolysis of a solution of the NaOH containing excess of  $KHSO_3$  and KBr. The solution remains alkaline until the  $KHSO_4$  formed is equiv. to the NaOH present. The reactions are  $KHSO_3 + O = KHSO_4$  and  $KHSO_4 + NaOH = KNaSO_4 + H_2O$ . Bromocresol-green is used as indicator. The amount of NaOH present is found from the wt. of Ag deposited. Stirring by means of  $N_2$  or  $H_2$  is essential.

VII. For the determination of  $NH_2OH$  the reaction with electrolytically-produced Br cannot be used in acid solution owing to the formation of significant amounts of nitrite, but in neutral solution a sharp endpoint can be obtained. Electrolysis is best carried out at 60—65°. As in former determinations the excess of Br is found by means of 0.01N- $Na_2S_2O_3$ , and the total Br produced from the KBr by means of the Ag coulometer. Details of procedure and a comparison showing agreement with vals. obtained by the bromate method of Kurtenacker *et al.* (A., 1922, ii, 312) are given. L. S. T.

**Colorimetric micro-determination of phosphorus with the Pulfrich photometer.** F. ROTHSCHILD (Klin. Woch., 1936, 15, 792—793; Chem. Zentr., 1936, ii, 1983).—A method ( $\pm 2\%$ ) suitable for series determinations is described. A. H. C.

**Determination of phosphates in water.**—See B., 1938, 852.

**Determination of phosphorus in coal.**—See B., 1938, 748.

**Gold bromide as redox indicator and catalyst in determination of arsenites by cerium sulphate.** L. SZEBELLÉDY and S. TANAY (Pharm. Zentr., 1938, 79, 383—385).—The arsenite solution is treated with 10 c.c. of fuming HCl, 1 c.c. of 1%  $AuCl_3$ , 2 g. of NaBr, and sufficient  $H_2O$  to make 100 c.c. The colourless liquid is warmed to 50—60° and titrated with 0.1N- $Ce(SO_4)_2$  until one drop of the latter produces the characteristic yellow colour of the Na auribromide which is compared with a control. ICl is not necessary as a catalyst. J. N. A.

**Rapid oxidimetric determination of arsenic.** E. ERDHEIM and N. ZAHARIA (Österr. Chem.-Ztg., 1938, 41, 242—244).—2—3 g. of the finely powdered material are fused with a corresponding amount of  $Na_2O_2$ , the product being extracted with  $H_2O$  and the solution diluted to 500 c.c. An aliquot portion of the filtered solution is neutralised with 20%  $H_2SO_4$  and then rendered slightly alkaline by addition of  $NaHCO_3$ . 30—40 c.c. of aq.  $Na_2SO_3$  (160 g. per l.), 40—50 c.c. of 3%  $NH_4$  molybdate solution, and 60—70 c.c. of dil.  $H_2SO_4$  are then added and the solution is boiled until the odour of  $SO_2$  disappears. The solution is titrated with  $KMnO_4$  (1 c.c. of 0.1N- $KMnO_4 = 0.0037455$  g. As). J. W. S.

**Determination of boric acid.** E. PERCS (Magyar Gyóg. Társas. Ert., 1936, 12, 318; Chem. Zentr., 1936, ii, 1383).—The use of 3% phenolphthalein and 0.2% methylene-blue in EtOH solution is recommended as indicator in the titration of  $H_3BO_3$  using 3 parts of glycerol. A. H. C.

**Analysis of boron carbide.**—See B., 1938, 798.

**Determination of silicon in aluminium and its alloys.**—See B., 1938, 802.

**Differentiation between felspar and quartz.**—See B., 1938, 777.

**Potentiometric determination of silica in silicate ores.**—See B., 1938, 783.

**Drop reaction for the detection of phosgene.** V. ANGER and S. WANG (Mikrochim. Acta, 1938, 3,



24—26).—The reaction between  $\text{COCl}_2$  and phenylhydrazine cinnamate to form diphenylcarbazine, which is then converted into its reddish-violet Cu salt, provides a drop reaction for  $\text{COCl}_2$  which can be applied as a test for purity to  $\text{CCl}_4$  and  $\text{CHCl}_3$ . The test is sensitive to 5  $\mu\text{g}$ . of  $\text{COCl}_2$  per drop and can be made on paper or in a micro-crucible. L. S. T.

**Determination of carbon in aluminium.**—See B., 1938, 802.

**Detection of carbon monoxide in medicinal oxygen.**—See B., 1938, 779.

**Determination of total alkali metals present as impurities in reagents.** E. S. PRSHEVALSKI and R. V. MERVEL (Sborn. Rabot Lab. Inst., 1937, 15, 58—68).—The determination of Na<sup>+</sup>, introduced into various reagents as  $\text{Na}_2\text{SO}_4$ , by pptn. of the reagent cation and subsequent weighing of the  $\text{H}_2\text{O}$ -extracted and calcined filtrate is described. The accuracy is dependent on the anion chosen to ppt. the reagent cation since  $\text{Na}_2\text{SO}_4$  is adsorbed by different ppts. in varying extent. Thus errors vary for the  $\text{SO}_4^{--}$ ,  $\text{CO}_3^{--}$ ,  $\text{OH}^-$ , and  $\text{S}^-$  by 19, 11, 7, and 4%, respectively. Presence of small quantities of  $\text{CaSO}_4$  as impurity invalidates the alkali metal determination owing to the solubility of this salt. D. G.

**Iodometric determination of alkalis.** P. I. ALEXEEV (Sborn. Rabot Lab. Inst., 1937, 15, 74—78).—Addition of  $\text{AgNO}_3$  to a solution of I in KI ppts.  $\text{I}^-$  and  $\text{IO}_3^-$  and liberates a quantity of H<sup>+</sup> equiv. to that of the I originally in solution. The alkali solution to be determined is added and part of the acid liberated by the  $\text{AgNO}_3$  is combined; the remainder is determined by adding KI and  $\text{KIO}_3$ , which again liberate I in quantity equiv. to the acid remaining, and by titration with  $\text{As}_2\text{O}_3$ . The alkali is determined from the difference between the amount of titrated I solution initially taken and that found at the end. D. G.

**Electrometric titration of calcium in chloride solutions.** A. CARIS (Z. Elektrochem., 1938, 44, 366—367).—The solution of  $\text{CaCl}_2$ , adjusted to  $p_{\text{H}}$  5—9, is titrated with  $(\text{NH}_4)_2\text{C}_2\text{O}_4$  using a Pb-amalgam electrode. The titration is slightly affected by the presence of other ions, but the effect is negligible in the case of small amounts of  $\text{K}^+$  and  $\text{NH}_4^+$ .

C. R. H.

**Principles and applications of absolute colorimetry.** XVIII. Absolute-colorimetric determination of magnesium. A. THIEL and E. VAN HENGEL (Ber., 1938, 71, [B], 1157—1162).—The method depends on the formation of a lake between  $\text{Mg}^{++}$  and 1 : 2 : 5 : 8-tetrahydroxyanthraquinone. The presence of a protective colloid is therefore necessary, gum arabic being suitable if freed from Mg which is usually present. The solution, which must not contain more than 0.8 mg. in the sample and must not be strongly acidic or contain much  $\text{NH}_4$ , is mixed with 10 c.c. of gum arabic solution, 10 c.c. of dye solution, and 10 c.c. of NaOH and made up to 100 c.c. The colour develops immediately and remains unchanged for <30 min., after which it gradually becomes paler. The solution is observed in a 25-mm. layer using filter SF9 (600 m $\mu$ .) If <23 mm. is observed on the grey

solution side the Mg content is too small for the dye used, and the process is repeated with only 4 c.c. of dye solution per 100 c.c., the layer being 50 mm. If in the first case >31.5 mm. of grey solution are required, the experimental solution is too conc. and must be diluted or used in smaller quantity. The Mg contents corresponding with thicknesses of the grey solution are tabulated. Foreign cations except the alkali metals may not be present. If much Al is present special precautions are necessary owing to the adsorptive power of  $\text{Al}(\text{OH})_3$  for  $\text{Mg}(\text{OH})_2$ . A suitable treatment consists in dissolution of the  $\text{Al}(\text{OH})_3$  in NaOH. Al-Mg alloys are best directly treated with NaOH. H. W.

**Adsorption of diazo-compounds on cadmium and magnesium hydroxides.** V. "Cation 2B" for micro-detection of magnesium. F. P. DWYER (J. Proc. Austral. Chem. Inst., 1938, 5, 197—200; cf. A., 1938, I, 212).—Procedure for the detection of <0.08  $\mu\text{g}$ . of Mg per c.c. in a 10-c.c. sample is described. Cd and Mg may be detected in the same solution. In presence of other metals Mg is detected after the conversion of these into complex cyanides. The sensitivity of "Cation 3B," which can also be used, is 1  $\mu\text{g}$ . of Mg per c.c. F. L. U.

**Volumetric determination of magnesium.** G. DONATELLI (Annali Chim. Appl., 1938, 28, 122—125).—Mg is pptd. as  $\text{MgNH}_4\text{PO}_4$ ; the ppt. is separated, washed with 95% EtOH, dried at 45—50°, suspended in  $\text{H}_2\text{O}$ , and titrated to Me-orange with 0.1N- $\text{H}_2\text{SO}_4$ . The method is applicable to the determination of  $\text{PO}_4^{--}$ . F. O. H.

**Determination of magnesium oxide in limestones.**—See B., 1938, 777.

**Analysis of fluxes used in the production of magnesium.**—See B., 1938, 801.

**Determination of impurities in zinc and zinc alloys.**—See B., 1938, 796.

**Spectrographic determination of impurities in commercial cadmium.**—See B., 1938, 797.

**Analysis of refined lead.**—See B., 1938, 797.

**Determination of copper in cyanide electrolytes.**—See B., 1938, 803.

**Determination of copper by internal electrolysis.**—See B., 1938, 803.

**Determination of copper in rubber.**—See B., 1938, 817.

**Micro-determination of copper and zinc in aluminium and magnesium alloys.**—See B., 1938, 802.

**Determination of copper in presence of lead.**—See B., 1938, 795.

**Determination of copper and bismuth in lead-zinc ores by internal electrolysis.**—See B., 1938, 796.

**Determination of copper and iron in wines.**—See B., 1938, 834.

**Pharmaceutically important arsenic compounds.** III. Stability of arsenites towards atmospheric oxygen and their use for the de-



**termination of mercuric chloride.** K. BRAND and E. ROSENKRANZ (Pharm. Zentr., 1938, 79, 377—383; cf. A., 1937, II, 491).—The stability of arsenite solutions decreases in presence of alkali, which favours formation of arsenate. The various methods for determination of  $\text{Hg}_2\text{Cl}_2$  by reduction with arsenite and back-titration with I are discussed. Low results are obtained when  $\text{NaOAc}$  is used as the alkali due to formation of some  $\text{Hg}_2\text{Cl}_2$ , but good results are secured by use of  $\text{Na}_2\text{HPO}_4$  or  $\text{Na}_2\text{B}_4\text{O}_7$ . J. N. A.

**Detection of the rare earths by means of the fluorescence of their bivalent ions.** K. PRZIBRAM (Mikrochim. Acta, 1938, 3, 68—72).—The characteristic fluorescence bands shown by Eu, Yb, Sm, and Tm (cf. A., 1938, I, 384) can be used for the detection of small amounts of these elements.

L. S. T.

**Colorimetric determination of aluminium by means of eriochrome-cyanine-R.** I. T. MILLNER. II. T. MILLNER and F. KÚNOS (Z. anal. Chem., 1938, 113, 83—102, 102—119).—I. The interaction of  $\text{Al}^{+++}$  and eriochrome-cyanine-R (I) has been investigated by extinction coeff. measurements on solutions of the dye with and without addition of  $\text{AlCl}_3$ . At  $p_{\text{H}}$  5.4 ( $\text{NaOAc}$ - $\text{AcOH}$  buffer solution) the lake formed has a const. composition corresponding with 3 mols. of (I) to 1 atom of Al, but the mols. of (I) are not equally bound. The increase in the extinction coeff. due to addition of  $\text{Al}^{+++} \propto [\text{Al}^{+++}]$ , and is almost independent of the amount of excess (I) present; it therefore permits determination of small amounts of Al.

II. In  $\text{NaOAc}$ - $\text{NaOAc}$  buffer solutions of  $p_{\text{H}}$  4.6—5.6 (I) gives a much deeper coloured lake that that formed in equiv.  $\text{NH}_4\text{OAc}$ - $\text{NaOAc}$ - $\text{AcOH}$  buffer solutions. From the effects of the method of prep. of (I),  $p_{\text{H}}$ , and time of keeping on the colour developed it is inferred that an equilibrium exists between two forms of (I), only one of which is capable of forming a deeply coloured lake. In the preferred method for determining  $\text{Al}^{+++}$ , 5 c.c. of HCl solution containing  $>15 \mu\text{g.}$  of Al are treated with 1.5 c.c. of 1% aq. (I) and 2N-NaOH is added till a pale green ppt. is formed. After adding a few more drops of NaOH, 0.2N-AcOH is added until a pale yellow colour is obtained. 15 c.c. of buffer solution ( $\text{NaOAc}$ . $3\text{H}_2\text{O}$  14.2 g.,  $\text{AcOH}$  1.74 g. per l.) are added and the solution is diluted to 25 c.c. A blank solution without Al is also prepared, and both are kept for 20 hr., after which the colours are compared. The  $[\text{Al}^{+++}]$  is deduced from measurements on standard solutions. J. W. S.

**Spectrum analysis of aluminium alloys in the visible region of the spectrum.**—See B., 1938, 802.

**Detection of iron by catalysis.** L. SZEBELLÉDY and M. AJTAI (Mikrochim. Acta, 1938, 3, 21—23).—The catalytic acceleration of the reaction between  $\text{H}_2\text{O}_2$  and *p*-phenetidine by the  $\text{Fe}^{II}$  dipyriddy complex forms the basis of a drop reaction for Fe. 0.1 c.c. of 0.01% *p*- $\text{NH}_2\text{C}_6\text{H}_4\text{OEt}$ .HCl, one drop of 2% EtOH solution of 2 : 2'-dipyriddy, and 0.1 c.c. of 0.2%  $\text{H}_2\text{O}_2$  are added to a drop of the neutral Fe solution. In presence of Fe the solution is coloured red either immediately or after heating on the  $\text{H}_2\text{O}$ -bath for 1—5 min., while a "blank" remains colourless or

faintly pink. The limit of identification is 0.001  $\mu\text{g.}$  of  $\text{Fe}^{++}$  per 0.1 c.c. of tested solution. L. S. T.

**Analysis of special cast irons and steels.**—See B., 1938, 792.

**Rapid determination of iron in slags.**—See B., 1938, 791.

**Colorimetric determination of small quantities of iron oxide in glasses and glass-making sands.**—See B., 1938, 783.

**Oxidimetric and colorimetric determination of cobalt in steel.**—See B., 1938, 794.

**Quantitative electrodeposition of cobalt.**—See B., 1938, 804.

**Volumetric determination of nickel.** N. KAMINSKI and P. KAMNSKAJA (Maslob. Shir. Delo, 1938, No. 3, 17—18).—Minor modifications of Krupenio's method (A., 1937, I, 478) are described. R. T.

**Determination of chromium in chromite ores.**—See B., 1938, 797.

**Analysis of molybdenum [ores].**—See B., 1938, 797.

**Spectrum analysis of minerals for tin, tungsten, and molybdenum.**—See B., 1938, 797.

**Gravimetric determination of germanium.** G. R. DAVIES and (SIR) G. T. MORGAN (Analyst, 1938, 63, 388—397).—Existing methods (pptn. as  $\text{GeS}_2$  and conversion into  $\text{GeO}_2$ , pptn. as  $\text{Mg}_2\text{GeO}_4$ , and pptn. as pyridine germanomolybdate) are critically discussed and two new methods, based on pptn. with tannin and as cinchonine germanomolybdate, are described. For the former, 50—60 mg. of  $\text{GeO}_2$  in 150—250 ml. of solution are treated with  $\text{H}_2\text{SO}_4$  and  $(\text{NH}_4)_2\text{SO}_4$  and heated almost to boiling. 10—30 ml. of 5% aq. tannin are slowly added, and the ppt. which forms is washed with a solution of  $\text{HNO}_3$ ,  $\text{NH}_4\text{NO}_3$ , and tannin, collected, and ignited to  $\text{GeO}_2$ . The procedure in presence of a no. of other metals is described. In the second method, the ppt. has the formula  $(\text{C}_{19}\text{H}_{22}\text{ON}_2)_4\text{H}_4[\text{GeMo}_{12}\text{O}_{40}]$ , = 2.385% of Ge. 40 ml. of the solution containing  $>4 \text{ mg.}$  of Ge are treated with  $\text{NH}_4\text{NO}_3$ ,  $\text{NH}_4$  molybdate,  $\text{HNO}_3$ , and 2.5% cinchonine in 0.25N- $\text{HNO}_3$ . The mixture is kept for 2—4 hr., and the ppt. is collected, washed with  $\text{NH}_4\text{NO}_3$ - $\text{HNO}_3$ , and dried at 160°. E. C. S.

**Determination of vanadium in ferrochrome.** I. WADA and R. ISHII (Bull. Inst. Phys. Chem. Res. Japan, 1938, 17, 434—444).—Difficulty in the determination of V in Fe-Cr alloys by the  $\text{FeSO}_4$  method is overcome by first converting the Cr into a sol. Cr salt and extracting the latter with  $\text{Et}_2\text{O}$ . J. A. D.

**2 : 3 : 7-Trihydroxy-9-methyl-6-fluorone, a micro-qualitative reagent for antimony.** P. WENGER, R. DUCKERT, and C. P. BLANCPAIN (Mikrochim. Acta, 1938, 3, 13—20; cf. A., 1938, I, 46).—Limits of identification are 0.2, 0.5, and 0.8  $\mu\text{g.}$  on spot-plate, gelatin paper, and filter-paper, respectively. L. S. T.

**Gold bromide as redox indicator in the bromometric determination of antimonite ions.** L. SZEBELLÉDY and W. MADIS (Mikrochim. Acta, 1938, 3, 1—3).— $\text{NaAuBr}_2$  and  $\text{NaAuBr}_4$  act as reversible



redox indicators for the macro- or micro-determination of  $\text{Sb}^{+++}$  by titration with  $\text{KBrO}_3$  in presence of conc.  $\text{HCl}$  and  $\text{KBr}$ . On the macro-scale an accuracy equiv. to  $\pm 0.01$  c.c. of  $0.1N$ - $\text{KBrO}_3$  can be attained. The results agree with potentiometric determinations. Details of procedure for micro-determinations are given. L. S. T.

**Volumetric determination of bismuth as bismuth hydrogen iodide oxine.** I. M. KOLTHOFF and F. S. GRIFFITH (*Mikrochim. Acta*, 1938, 3, 46—51).—A crit. investigation of the determination of Bi as  $\text{C}_9\text{H}_7\text{ON}\cdot\text{HBiI}_4$  by Berg and Wurm's method (A., 1927, 847), which is found to give low (1%) results. In the modified method recommended the excess of I' is determined by Andrews' ICl method after pptn. and removal of the Bi compound. The final concn. of  $\text{H}_2\text{SO}_4$  or  $\text{HNO}_3$  after pptn. can be  $1N$  without affecting the results, but with a chloride concn.  $>0.08N$  low results are obtained. For macro-amounts of Bi the accuracy of the method described is  $\sim \pm 0.3\%$ , and for amounts of  $\sim 0.25$  mg. the indirect method given is accurate to approx.  $\pm 5\%$  (cf. A., 1936, 180).

L. S. T.

**Gravimetric determination of bismuth with picric acid.** H. ETIENNE (*Bull. Soc. chim. Belg.*, 1938, 47, 287—303).—Bi can be separated from Pb by rendering its solution slightly acid with  $\text{HNO}_3$ , adding excess of picric acid, and neutralising to Meorange with  $(\text{NH}_4)_2\text{CO}_3$ . The Bi is pptd. as  $\text{Bi}(\text{OH})_2\cdot\text{O}\cdot\text{C}_6\text{H}_2(\text{NO}_2)_3$  (I), which is washed with dil. aq. picric acid (0.5 g. per l.). In presence of large quantities of Pb a double pptn. is necessary. If the  $\text{Bi}_2\text{O}_3$  content is  $>0.01$  g., (I) is converted into  $\text{Bi}_2(\text{CO}_3)_3$  by boiling with excess of aq.  $(\text{NH}_4)_2\text{CO}_3$ . The  $\text{Bi}_2(\text{CO}_3)_3$  or (I) is dissolved in  $\text{HNO}_3$ , the solution evaporated, and the residue ignited and weighed as  $\text{Bi}_2\text{O}_3$ . The separation is unaffected by the presence of Cu and Cd, but is influenced by Fe,  $\text{H}_3\text{PO}_4$ , and  $\text{H}_3\text{AsO}_4$ . In the case of a complex mixture, Bi is separated with the other metals of its group by  $\text{H}_2\text{S}$  and  $\text{Na}_2\text{S}$ , the sulphides are extracted with  $\text{HCl}$ , and then converted into nitrates before treatment with picric acid. J. W. S.

**Quantitative separation of niobium and titanium.** V. S. BIKOVA (*Compt. rend. Acad. Sci. U.R.S.S.*, 1938, 18, 655—657).—Where Ta-Nb separation is not to follow, a modification of Schoeller's  $\text{K}_2\text{S}_2\text{O}_7$ -tannin method (A., 1937, I, 99) is suitable for low [Nb]. For large amounts, preliminary pptn. of most of the Nb almost free from Ti is effected by addition of  $\text{H}_3\text{BO}_3$  to an acid ( $\text{HCl}$ ) tannin solution of the fluorides. Detailed procedure and results show this combination to be simpler than the oxalate-salicylate method and of equal accuracy. I. MCA.

**Microchemical detection of gold without reagents.** C. DUVAL and P. FAUCONNIER (*Mikrochim. Acta*, 1938, 3, 30—32).—The solution of Au salt is evaporated in a capillary (glass or Pyrex) and the residue is heated so as to embed it in molten glass. The Au spangle formed becomes visible through the magnifying effect of the glass. The limit of identification is  $1\mu\text{g.}$  in 0.05 c.c. With smaller amounts of Au down to  $0.05\mu\text{g.}$  per 0.05 c.c. a pink thread is formed. The test is independent of the

acidity of the original solution. Cu is the only metal likely to interfere and this can be overcome by dilution. The method can be applied to the detection of Au in Au-Cu alloys, in photographic toning solutions, etc.

L. S. T.

**Micro-titration of platinum in cupellation beads.**—See B., 1938, 799.

**Thermal constants at high temperatures.** I. Dilatometer for measurement of linear expansion coefficients. P. G. STRELKOV (*Physikal. Z. Sovietunion*, 1937, 12, 23—34).—A quartz dilatometer, comprising an Abbe-Zeiss thickness meter, has been constructed for measurement of linear expansion coeffs. The oven is maintained const. to  $0.01^\circ$  and the temp. is measured to within  $0.2^\circ$ . Sources of error, such as expansion of the measuring instrument, are eliminated by null-point measurements. J. A. D.

**Semi-micro sublimation apparatus.** C. M. MARBERG (*J. Amer. Chem. Soc.*, 1938, 60, 1509—1510).—Apparatus and technique are described.

E. S. H.

**Combustion calorimeters.** S. W. LIPIN (*Z. Instrumkde.*, 1938, 58, 193—207).—Four different types of combustion calorimeter have been examined experimentally and the advantages and defects of each are critically reviewed. W. R. A.

**Control of humidity and construction of a constant-temperature and humidity cabinet for laboratory use.** F. E. HUMPHREYS (*J. Soc. Leather Trades' Chem.*, 1938, 22, 224—232).—A cabinet capable of maintaining const. conditions of temp. and R.H. is described. Temp. is controlled by means of two Hg-PhMe regulators (one to operate the heating lamps and the other to control a supply of cooling  $\text{H}_2\text{O}$ ), and the humidifier by means of a strip of gold-beater's skin. D. P.

**High-temperature vacuum furnace for spectroscopic work.** K. R. MORE (*Rev. Sci. Instr.* 1938, 9, 199—200).—The furnace described, designed to attain  $2000^\circ$  or higher with moderate power consumption, employs a W coil heating element and works with 2.5 kw. N. M. B.

**Rotary quartz compensator with large measuring range at high accuracy.** A. EHRLINGHAUS (*Z. Krist.*, 1938, 98, 394—406; cf. *ibid.*, 1931, 76, 315).—Scope and performance of this microscope accessory comprising two suitably cut and oriented plates of equal thickness are compared with those of the Babinet wedge. I. MCA.

**Mechanical registration of the values measured by a polarisation spectro-photometer.** L. HONTY (*Z. Instrumkde.*, 1938, 58, 212—213).

W. R. A.

**Recording photo-electric spectroradiometer.** V. M. ALBERS and H. V. KNORR (*J. Opt. Soc. Amer.*, 1938, 28, 121—123).—The instrument is designed for absorption measurements in the visible and near infra-red regions; it consists of a quartz monochromator, photo-cell, amplifier, and recorder.

A. J. E. W.

**Transmission factor of a spectroradiometer.** K. K. KAY and H. M. BARRETT (*J. Opt. Soc. Amer.*,



1937, 27, 65—68).—In using a spectroradiometer to evaluate the radiant flux of an energy source in abs. units a spectral and a transmission correction factor must be employed. A simple method of determining the latter by means of measurements at various distances is described.  
N. M. B.

**Polarisation phenomenon in the Hilger  $E_1$  quartz spectrograph.** J. W. ELLIS and J. KAPLAN (*J. Opt. Soc. Amer.*, 1937, 27, 94; cf. A., 1936, 1084).—An explanation of an anomaly in the observed intensity max. and min. is given.  
N. M. B.

**Determination of the m.p. of porphyrins and other darkly-coloured substances with the use of polarised light.** C. RIMINGTON and P. SYMONS (*Mikrochim. Acta*, 1938, 3, 4—6).—The use of polarised light with an analysing eye-piece is advantageous in determining the m.p. of porphyrins with the Kofler apparatus.  
L. S. T.

**Limits of volumetric analysis. Use of a new micro-titration apparatus.** M. OTT (*Z. anal. Chem.*, 1938, 113, 81—83).—The apparatus employs a colour comparator, fitted with a series of light filters to facilitate accurate observation of the endpoint. The solution is stirred automatically, whilst to accelerate replacement of the solution without disturbing the stirrer the titration cell is fitted with a small siphon. The apparatus can also be used for  $p_H$  measurements and for determination of vitamins.  
J. W. S.

**Volume formula for calculating  $p_H$  when using a simple colorimeter wedge.** K. KELLER (*Z. anal. Chem.*, 1938, 113, 8—21).—A formula is deduced for calculating the depth of colour of a solution examined in a Hellige wedge colorimeter, and is applied to study of the  $p_H$  vals. of  $\text{CO}_2$ - $\text{HCO}_3$  solutions.  
J. W. S.

**Chromaticity limitations of the best physically realisable three-filter photo-electric colorimeter.** J. A. VAN DEN AKKER (*J. Opt. Soc. Amer.*, 1937, 27, 401—407).—The best physically realisable three-filter photo-electric colorimeter suffers from fundamental chromaticity limitations. Its use as a colour comparator is discussed.  
F. J. L.

**Submarine photometer for studying the distribution of daylight in the sea.** C. L. UTTERBACK and P. M. HIGGS (*J. Opt. Soc. Amer.*, 1938, 28, 100—102).—The instrument described is suitable for rapid measurements of both transmitted and scattered light in narrow spectral bands.  
A. J. E. W.

**Design of monochromatic filters for the type H-3 mercury lamp.** E. M. STAATS (*J. Opt. Soc. Amer.*, 1938, 28, 112—120).—Full details are given for the design of double glass filters for isolating the Hg radiations at 365, 405, 436, 546, 578, and 1014  $m\mu$ .  
A. J. E. W.

**Light sources for visible and ultra-violet.** J. G. WINANS (*Rev. Sci. Instr.*, 1938, 9, 203).—The two sources described are an evacuated quartz tube with external electrodes, heated with a Bunsen burner, and containing 1 c.c. of Hg, and a modified 85-watt Hg lamp.  
N. M. B.

**Comparison of X-ray photographs taken with X and Y built-up films.** S. BERNSTEIN (*J. Amer. Chem. Soc.*, 1938, 60, 1511).—The X-ray photographs are independent of the contact potentials of the films (cf. A., 1938, I, 76).  
E. S. H.

**Qualitative and quantitative study of radiation sources and photographic emulsions in the ultra-violet region.** P. GESTEAU (*Compt. rend.*, 1938, 206, 1630—1631).—The incident light intensity from a source is varied by a system of polarising prisms, one of which is rotated simultaneously with the traverse of a photographic plate registering the incident light. The thresholds of two emulsions, or the intensities of two light sources, may be compared by measuring the lengths of the blackened tracks obtained in each case.  
A. J. E. W.

**Simple glass electrode of small capacity.** J. B. PETTIGREW and G. M. WISHART (*Biochem. J.*, 1938, 32, 1075—1077).—The capillary glass electrode described holds about 0.2 ml., has a resistance of 10—50  $M\Omega$ , and gives readings stable to within 0.2 mv.  
W. O. K.

**Submerged electrode apparatus for spectroscopic analysis.** F. TODD (*J. Chem. Educ.*, 1938, 15, 241—242).—In the electrode described Pt wire electrodes are placed in a solution or suspension of the substance under test. The electrodes are connected to an ordinary 110-v., 60-cycle a.c. The 31 elements tabulated give satisfactory lines for a visual qual. analysis, which can be carried out in 5—35 min. Limits of detection vary from 0.009 mg. per c.c. with Na to 5 mg. per c.c. with K. Al, As, B, C, Cs, Mo, P, Rb, S, Sb, Se, Ti, Te, U, V, and W do not give suitable lines with this-electrode.  
L. S. T.

**Detector properties of the compounds contained as inclusions in steel.** J. CZOCHRALESKI and W. SZNUK (*Wiadom. Inst. Met.*, 1936, 3, 3—4; *Chem. Zentr.*, 1936, ii, 1979).—The radiomicroscope shows a weak detector action of the Fe and Fe Mn silicates, but not the Mn silicates, occurring as inclusions in steel. The effect is not suitable, at present, for the identification of the silicates in steel.  
L. S. T.

**Use of alternating current mains in electro-lytic analysis.** A. J. LINDSEY (*Analyst*, 1938, 63, 425—426).—A means of obtaining d.c. sufficiently free from ripple for quant. deposition and separation of metals is described.  
E. C. S.

**Continuous electron counter.** O. ZEHLER (*Z. Instrumkde.*, 1938, 58, 207—209).—Apparatus is described.  
W. R. A.

**Accidental coincidences in counter circuits.** C. ECKART and F. R. SHONKA (*Physical Rev.*, 1938, [ii], 53, 752—756).—Statistical considerations are examined in relation to counter circuits.  
N. M. B.

**Electron multiplier as an electron-counting device.** Z. BAY (*Nature*, 1938, 141, 1011; cf. A., 1938, I, 216).—An electron-counting device based on the secondary emission principle has been constructed. The use of liquid air to suppress thermal emission is unnecessary when thin layers of BaO on a Ni base are used as multiplying electrodes. With a ten-stage multiplier a multiplication of  $10^4$  is attained. The



device can be used for counting  $\gamma$ -rays and has a resolving power  $\gg$  that of gas-filled counters.

L. S. T.

**Anomalous diminution of sparking electrodes.** M. MASIMA (Bull. Inst. Phys. Chem. Res. Japan, 1938, 17, 404—409).—Oil vapour causes anomalous diminution of Pt-Ir and Ag electrodes during discharge at const. current intensity.

J. A. D.

**Photo-electric current-limiting device for insulation measurements.** E. B. BAKER and H. A. BOLTZ (Rev. Sci. Instr., 1938, 9, 196—198; cf. A., 1936, 305).—The use of a saturated diode to limit the current flowing through the sample, in the event of electrical breakdown, in the measurement of small currents at high direct potentials (conductivity of liquid insulators) has the disadvantage, when used in series, of taking a considerable potential drop across it during measurements. This is obviated by the substitution of the specially designed photo-electric cell described.

N. M. B.

**Potentiometric measurement of extremely small voltages.** I. AMDUR and H. PEARLMAN (Rev. Sci. Instr., 1938, 9, 194—195).—The apparatus described, a combination of familiar principles, is constructed to measure d.c. e.m.f.  $<20 \mu\text{v}$ . accurate to  $10^{-9}$  v.

N. M. B.

**Characteristics of a strong ion source.** G. TIMOSHENKO (Rev. Sci. Instr., 1938, 9, 187—194).—The construction and operating characteristics of an ion source of the capillary arc type are described. The source yields  $0.4 \mu\text{-amp}$ . of singly charged A ions, and the beam can be focussed at ion-accelerating voltages of 1000—6000 v. The source has been used in studying the controlled sputtering of metals bombarded by A ions, and the accompanying secondary electron emission.

N. M. B.

**Device of the automatic regulation of a current in a Shearer X-ray tube.** H. LE CAINE (Canad. J. Res., 1938, 16, A, 100—104).—The circuit and mechanism described control the leak automatically so as to maintain a steady current, switch off the high-tension, and close the leak valve when the pressure rises excessively, and restart the tube when the vac. is restored. The tube current can be adjusted within very narrow limits.

T. H. G.

**Use of intense and extensive magnetic fields in recent researches.** A. COTTON (Nuovo Cim., 1938, 15, 23—30).—The construction of a large electromagnet giving fields up to 18,000 gauss is described.

O. J. W.

**Magnetic field corrections in the cyclotron.** M. E. ROSE (Physical Rev., 1938, [ii], 53, 715—719; cf. A., 1938, I, 222).—To obtain the essential homogeneity of the magnetic field so that the ions in the cyclotron may attain high energies, the correction for the decrease in the field near the edge of the pole pieces is effected by the insertion of "shims." A method of determining the dimensions of any shape of shims is given, and vals. are found for shims in the form of a ring of rectangular cross-section placed at the edge of the cyclotron chamber.

N. M. B.

**Laboratory magnetic separator.**—See B., 1938, 807.

**Weight burettes and their use. Reversible titrations.** F. L. HAHN (Mikrochim. Acta, 1938, 3, 7—12).—Three types of wt. burette are described. Increased accuracy can be attained by first titrating a sample in the usual way, then adding an excess of the reagent, and back titrating with a solution of the substance under test. The average of such a series is free from the error inherent in titrations carried out always in the same direction.

L. S. T.

**Metal vacuum desiccator with a glass cover.** S. ORLIĆ (Arh. Hemiju, 1938, 12, 22—25).

R. T.

**Metal evaporators.** H. B. DE VORE (Rev. Sci. Instr., 1938, 9, 202).—For evaporation of 0.1—1 g. of metal, and to prevent the formation of alloys with the W coil, the W is insulated with  $\text{Al}_2\text{O}_3$  sprayed as a suspension in a cellulose nitrate binder and fired at  $1700^\circ$ . In the case of  $<0.1$  g. of metal, Ag is first electroplated, clamped, or wrapped around a Ni tube coaxial with the W wire; Sn and Al are allowed to form beads between a Mo coil and the insulated W filament. Ni can be evaporated similarly, or by enclosing the entire heater in a Ni tube.

N. M. B.

**Glass capillaries with a rectangular cross-section.** H. W. LEIGHTON and N. D. SMITH (Rev. Sci. Instr., 1938, 9, 201—202).—Two methods of preparing the capillaries by pressing the heated tube between graphite blocks with lateral restriction by means of steel spacers, and by pressing in a rectangular groove milled in a graphite plate, are described.

N. M. B.

**Adjustable leak valve.** W. L. EDWARDS and L. R. MAXWELL (Rev. Sci. Instr., 1938, 9, 201).—The improved needle valve described operates axially without rotation, and can accurately control a small gas flow in either direction.

N. M. B.

**Measurement of the flow of gases. New anemometer.** F. ROHNER (Helv. Chim. Acta, 1938, 21, 817—820).—In the instrument described the usual capillary constriction serving to convey the gas stream is replaced by a U-shaped capillary tube passing through the Hg of a manometer inserted in series in the gas line, the ends of the capillary tube being open to the gas.

J. W. S.

**Determination of diffusion coefficients of gases in liquids.** A. RINGBOM (Z. anorg. Chem., 1938, 238, 94—102).—Apparatus and procedure are described and data for  $\text{CO}_2$  in  $\text{H}_2\text{O}$  at 25— $40^\circ$  recorded. The vals. vary with  $\eta$  and temp. of the  $\text{H}_2\text{O}$  approx. according to the Stokes-Einstein law.

E. S. H.

**Precision densimetry.** B. PESCE (Gazzetta, 1938, 68, 230—240).—Methods of measuring  $d$  by means of a pycnometer and a float, which give an accuracy of  $\pm 1$  and  $0.1 \mu\text{g}$ . respectively, are described.

O. J. W.

**Viscosimetry.**—See B., 1938, 743.



## Geochemistry.

**Distribution of the constituent gases and their pressures in the upper atmosphere.** S. K. MITRA and H. RAKSHIT (*Indian J. Physics*, 1938, **12**, 47—62).—If the upper atm. consists of  $N_2$  and O then the region above 250 km. will consist largely of O atoms. This does not agree with observations on high altitude auroral spectra, which show a greater intensity of the negative bands of N. Since the ionisation of the F region of the ionosphere persists all night it may be that the constituents of the upper atm. are  $N_2$  and  $O_2$ . T. H. G.

**Theory of molecular dissociation and fundamental mechanisms in the upper atmosphere.** R. C. MAJUMDAR (*Indian J. Physics*, 1938, **12**, 75—86).—A formula giving the degree of mol. dissociation under the influence of solar ultra-violet light is deduced.  $O_2$  mols. in the air are completely dissociated at a height of 167 km. assuming a temp. of 300° K. and a mol. wt. corresponding with the average mass of the  $N_2$  mols. The constituents and the mechanism of the fundamental processes in the ionosphere are discussed. T. H. G.

**Nitrogen and argon in the earth's crust.** (LORD) RAYLEIGH (*Nature*, 1938, **141**, 970; cf. A., 1938, I, 280).—Igneous rocks contain approx.  $3 \times 10^{-2}$  c.c. of N per g., most of which is chemically combined. The ratio of A to N is approx.  $1.3 \times 10^{-3}$ , and is < that of the atm. The total N content of the rocks is  $\gg$  that of the atm. L. S. T.

**Presence of krypton, xenon, and other noble gases in the Tuscan boraciferous soffioni. Geochemical aspects of the composition of soffioni.** U. SBORGI (*Mem. R. Accad. Ital.*, 1937, **8**, 533—558).—The pressure of Kr and of Xe in the natural gases from the soffioni has been confirmed. The concn. ratios Kr : A and Xe : A are 1.626 and 3.544 times the corresponding vals. for air. The composition of the soffioni gases is discussed from the geochemical viewpoint. O. J. W.

**Analysis of the [mineral] water of S. Elena di Chianciano [Siena].** M. T. GUERRITORE (*Annali Chim. Appl.*, 1938, **28**, 110—115).—Data for the chemical constituents, physico-chemical properties, and radioactivity are given. F. O. H.

**Mineral water from springs in Farfa in Sabina (Rieti).** M. TALENTI (*Annali Chim. Appl.*, 1938, **28**, 174—187).—Chemical, physico-chemical, and biological properties are recorded. O. J. W.

**Radioactivity of the thermal waters, gases, and deposits of Yellowstone National Park.** H. SCHLUNDT and G. F. BRECKENRIDGE (*Bull. Geol. Soc. Amer.*, 1938, **49**, 525—538).—Apparatus and methods for the examination of gases, waters, and solids are described. Data for the radioactivity of the gases, waters, and spring deposits and rock samples are tabulated. Similar data are recorded for the radioactivity of the hot springs at Thermopolis, Wyoming, and a comparison with the radioactivity of waters from different parts of the world is made. The above vals., obtained in 1936, agree with those obtained in

1906 (A., 1911, ii, 360). No correlation between radioactivity and the surface temp. of a spring or its  $p_H$  has been found. Although the radioactivity is low the amount for a long period of time is large. 33.9 g. of Ra equiv., mainly as Rn, are calc. to be discharged by Hot River during one year. The calc. amount of Ra discharged is approx. 90 mg. L. S. T.

**Medical hydromineralogy of Angola.** A. DE AGUIAR (*Rev. Chim. pura appl.*, 1934, [iii], **9**, 1—9; *Chem. Zentr.*, 1936, ii, 1989).—Analyses and evaluation of two waters, from Balombo and Botera, have been made. One is a thermal  $H_2O$  (50°) of small salt content, and the other, an alkaline mineral  $H_2O$  with 3.2245 g. of residue per l. L. S. T.

**Study of suspended sediments in estuaries and rivers.** L. GLANGEAUD (*Compt. rend.*, 1938, **206**, 1667—1669).—An apparatus for collecting suspended matter from 200-l. samples of  $H_2O$  is described. A. J. E. W.

**The Kaalijärvi meteorite from the Estonian craters.** L. J. SPENCER (*Min. Mag.*, 1938, **25**, 75—80).—The crater-lake on the island of Oesel has often been described since 1827 and many views have been expressed as to its mode of origin. The finding in 1937 of small rusted fragments of meteoritic Ni-Fe in two of the smaller associated craters now definitely proves that they are explosion craters formed when large meteorites fell. The metal shows the effects of heating; micro-analysis by M. H. HEY gave Fe 91.50, Ni 8.32%. One piece shows enclosed blebs of schreibersite surrounded by graphite. A large mass of metal found in the vicinity is artificial grey cast Fe with flakes of graphite. L. J. S.

**Australites : a unique shower of glass meteorites.** C. FENNER (*Brit. Assoc.*, 1937; *Min. Mag.*, 1938, **25**, 82—85).—A review is given of the different types of tektites and of the several theories of their origin. The similarity of type and the wide distribution of australites suggest a cosmic origin. Australites contain  $SiO_2$  about 70,  $Al_2O_3$  13,  $FeO + Fe_2O_3$  6,  $MgO$  2,  $CaO$  3,  $K_2O + Na_2O$  4%, and traces of Mn, Ti, Ni, and Co;  $\rho$  2.3—2.5. L. J. S.

**Number of mineral species.** A. E. FERSMAN (*Compt. rend. Acad. Sci. U.R.S.S.*, 1938, **19**, 269—272).—The no. of mineral species, within the accessible portion of the earth's crust, is  $\approx 3000$ . This is small compared with the no. of animal or vegetable species. The no. of mineral species in different geochemical systems depends on the thermodynamic character of the system and on the lattice energy levels of the species. W. R. A.

**Geochemical distribution laws of the elements. IX. Quantity ratios of the elements and the atomic species.** V. M. GOLDSCHMIDT (*Norske Vidensk.-Akad. Oslo, I, Mat.-Naturv. Kl.*, 1937, 148 pp.).—The distribution of the elements in the earth's crust, in meteorites, and in the atm. of the sun, stars, etc. is discussed. Data for the individual elements are given and geochemical conclusions reached from these data are discussed. L. S. T.



**Monothermite.** D. S. BELLANKIN (Compt. rend. Acad. Sci. U.R.S.S., 1938, 18, 673—676).—This constituent of Chassov-Jar and other Soviet clays is characterised by crystallo-optical data, chemical analysis, and dehydration-temp. curve. Its air-dried composition is  $(0.2\text{MO}, \text{Al}_2\text{O}_3, 3\text{SiO}_2, 1.5\text{H}_2\text{O}), 0.5\text{H}_2\text{O}$ , with dehydration stages at  $0-100^\circ$ ,  $400-500^\circ$ , respectively. Compared with normal kaolin, the absence of exothermic behaviour at  $\sim 900^\circ$  is ascribed to the function of the considerable  $\text{K}_2\text{O}$  content.

I. MCA.

**First nepheline syenite in Transcaucasia.** D. S. BELLANKIN, V. P. PETROV, and R. P. PETROV (Compt. rend. Acad. Sci. U.R.S.S., 1938, 19, 73—76).—The rocks are described and compositions as shown by chemical analysis are tabulated.

N. M. B.

**New localities of torbernite, autunite, and uraninite.** S. HATA and T. IMORI (Bull. Inst. Phys. Chem. Res. Japan, 1938, 17, 355—358).—Mineralogical features and chemical analyses are recorded for specimens from Okuma and Ohari, Japan.

I. MCA.

**Fergusonite from a new locality.** S. IMORI and S. HATA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, 34, 504—507).—At Iisaka, Japan, the mineral, unusually rich in Ta, occurs in prismatic crystals of  $\rho$  5.77, in a feldspar matrix. Typical forms are listed. A chemical analysis confirms the formula  $\text{R}_2\text{O}_3, (\text{Nb}, \text{Ta})_2\text{O}_5$ .

I. MCA.

**Crystalline form of acmite.** G. CESÀRO and J. MÉLON (Bull. Acad. roy. Belg., 1938, [v], 24, 180—212; cf. A., 1937, I, 484).—A detailed analysis of external morphology from goniometric data of the authors and others is given.

I. MCA.

**Fluorescence and phosphorescence phenomena in aragonitic calcites from Corund (Rumania).** S. VON GLISZCZYNSKI and E. STOICOVICI (Z. Krist., 1938, 98, 344—350; cf. *ibid.*, 1934, 88, 260).—The colour and intensity of the fluorescence and phosphorescence caused by separate exposure to ultra-violet and X-rays have been determined for 88 vari-coloured specimens from  $\text{H}_2\text{O}$ -deposited veins of ornamental calcite akin to Tecali marble. For ultra-violet excitation, intensities fall with depth of (specimen) colour, and a fleeting (0.05—0.1 sec.) red afterglow occurs with white specimens. With X-rays, intensities and duration of phosphorescence are smaller. The effects are possibly due to inclusions of rare earths, but not to aragonite which chemical and X-ray analyses show to be absent.

I. MCA.

**X-Ray examination of olivenite,  $\text{Cu}_2(\text{OH})\text{AsO}_4$ .** H. HERITSCH (Z. Krist., 1938, 98, 351—353).—From rotation and powder X-radiograms, the rhombic cell contains  $4 \text{Cu}_2(\text{OH})\text{AsO}_4$ , with  $a$  8.20,  $b$  8.62,  $c$  5.94 Å.;  $\rho_{\text{calc}}$  4.48. Indexed reflexions are listed. The probable space-group ( $D_{2h}^2$ ) differs from that of  $\text{Cu}_2(\text{OH})\text{PO}_4$  (A., 1936, 1483).

I. MCA.

**Migration of phosphoric acid during the decalcification of calcareous phosphates.** L. CAYEUX (Compt. rend., 1938, 206, 1229—1231).—Two series of observations on the Belemnite phosphatic minerals (Paris Basin) lead to the conclusion

that, in addition to the decalcification of the phosphates, there is a migration of  $\text{H}_3\text{PO}_4$  from the decalcified portions to the residue. J. A. D.

**State of crystallisation and thermomagnetic anomaly of lepidocrocite.** A. MICHEL and (MLLE.) M. GALLISSOT (Compt. rend., 1938, 206, 1252—1254; cf. A., 1935, 1063).—The anomaly in the magnetism-temp. curves of lepidocrocite is dependent on the size of the crystal aggregates. The anomaly is greatest when the crystal grains are largest and almost disappears when the grains are very fine. J. A. D.

**Xenotime and zircon from Iisaka.** S. HATA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, 34, 619—622).—Xenotime specimens from Iisaka contain Yt earths 51.82,  $\text{SiO}_2$  4.32, and  $\text{P}_2\text{O}_5$  25.38%. Complete analytical results are given. Zircon specimens contain Yt earths 10.23,  $(\text{Zr}, \text{Hf})\text{O}_2$  39.65,  $\text{SiO}_2$  23.00, and  $\text{P}_2\text{O}_5$  5.30% as chief constituents. These compositions are compared with those of previous specimens. J. A. D.

**Isomorphous substitutions in apatite.** I. D. BORNEMAN-STARINKEVITSCH (Compt. rend. Acad. Sci. U.R.S.S., 1938, 19, 253—255).—The chemical formula for fluoapatite,  $3\text{Ca}_3(\text{PO}_4)_2, \text{CaF}_2 = 2\text{Ca}_5\text{O}_9\text{O}_{12}\text{F}$ , can be written in the general form  $\text{A}_5\text{B}_3\text{X}_{13}$ . To include recorded isomorphous substitution products A may be Ca, Sr, Ce, Mn, Na, K, C; B, P, As, V, C, Si, S; and X, F, Cl, OH, O. Two new compounds are reported as constituents of Khibin apatites, viz.,  $\text{Ca}_4\text{CeP}_2\text{SiO}_{12}\text{F}$  and  $\text{Ca}_3\text{CeNaP}_3\text{O}_{12}\text{F}$ . Analyses are given for Khibin apatites from two beds, francolite, and elledite; these and revised data on a pure fluoapatite are discussed. W. R. A.

**Intergrowth of quartz and feldspars from the pegmatite veins of Karelia.** L. A. KOSSOR (Compt. rend. Acad. Sci. U.R.S.S., 1938, 19, 273—275).—During certain periods of vein formation, microcline and quartz can grow simultaneously. The ingrowths of quartz are usually, although not always, oriented definitely to the crystallographic elements of microcline. During growth the quantities of components may vary until all the microcline disappears and a quartz pocket is formed. Intergrowths of quartz with plagioclase relics from quartz pockets are accidental. W. R. A.

**Analysis of a single crystal of cleveite from Aust-Agder [Norway].** R. BAKKEN and E. GLEDITSCH (Tids. Kjemi, 1938, 18, 74—75).—Successive layers were stripped mechanically from the crystal and analysed. The  $\text{UO}_2 : \text{UO}_3$  and  $\text{Pb} : (\text{U} + 0.36\text{Th})$  ratios increased continuously towards the centre. The crystal was  $13 \times 10^8$  years old and took  $25 \times 10^6$  years to form. M. H. M. A.

**Mineralogical study of decolorising earth, gumbrine, from Georgia, U.S.S.R.** J. DE LAPPARENT (Ann. Off. nat. Comb. liq., 1937, 12, 1159—1182).—The probable constitution of the earth is  $\text{SiO}_2$  22, feldspar 2, kaolinite 8, montmorillonite 61, and alkali,  $\text{TiO}_2$ , and  $\text{H}_2\text{O}$  7%. Its properties are discussed. R. B. C.



**Keilhauite, a guide mineral to the Sterling granite gneiss of Rhode Island.** J. A. YOUNG, jun. (Amer. Min., 1938, 23, 149—152).—Keilhauite,  $\text{SiO}_2$  29.85,  $\text{TiO}_2$  30.65,  $\text{Al}_2\text{O}_3$  7.32,  $\text{Fe}_2\text{O}_3$  6.17,  $\text{FeO}$  none,  $\text{MnO}$  none,  $\text{MgO}$  none,  $\text{CaO}$  22.37,  $\text{H}_2\text{O}$  0.32,  $\text{Yt}_2\text{O}_3 + \text{Ce}_2\text{O}_3$  3.58, total 100.26% [analyst, F. A. GONYER], may be used to distinguish Sterling granite gneiss from other granite gneisses of similar appearance. There appears to be a gradation in properties from keilhauite to sphene. X-Ray powder diagrams for Rhode Island keilhauite and for sphene from Renfrew, Canada, show identical spacing and intensity.

L. S. T.

**Sun-burning of rocks.** J. E. HIBSCH (Z. deut. geol. Ges., 1938, 90, 17—19).—A criticism (cf. A., 1936, 1087). Sun-burning has been observed in basalts in which no glassy material is present, and it is absent in certain basalts that are rich in glassy material. An alternative explanation is provided by the unequal weathering of the layers forming a "coagulation" structure in rocks.

L. S. T.

**Pedocalic tendencies in soils of southern England.** F. F. KAY (Nature, 1938, 141, 925—926).—The occurrence of secondary depositions of  $\text{CaCO}_3$  in or below the surface soil in the Upper Greensand and Calcareous Grit formations of Berkshire is described.

L. S. T.

**Differentiation of the Glen More Ring-dyke, Mull.** C. KOOMANS and P. H. KUENEN (Geol. Mag., 1938, 75, 145—160).—New chemical analyses and the variation diagram are given. Deviations of the latter from the Normal Magma Series is discussed.

L. S. T.

**Diorites and associated rocks of the Glen Tilt Complex, Perthshire.** W. A. DEER (Geol. Mag., 1938, 75, 174—184).—Descriptions and chemical analyses of a biotite-granite, a muscovite-biotite granite, four intermediate granite-diorite hybrids, two acid hybrids, and a quartz-diorite are given.

L. S. T.

**Asthenolith (melting spot) theory.** B. WILLIS (Bull. Geol. Soc. Amer., 1938, 49, 603—614).—An asthenolith is a body of magma locally melted at any time in any solid portion of the earth. Geologic effects of asthenolithic activity are discussed.

L. S. T.

**Dating Cretaceous-Eocene tectonic movements in Big Horn Basin by heavy minerals.** M. H. STOW (Bull. Geol. Soc. Amer., 1938, 49, 731—761).—Heavy mineral analyses are included.

L. S. T.

**Petrology of the contact breccias of the Chelan batholith.** A. C. WATERS (Bull. Geol. Soc. Amer., 1938, 49, 763—794).—Seven chemical analyses of Chelan rocks are recorded.

L. S. T.

**Sylvine with uniformly deposited hæmatite.** J. LEONHARDT and R. TIEMEYER (Naturwiss., 1938, 26, 410—411).—The occurrence of sylvine with hæmatite uniformly deposited on it in the Niedersachsen pit at Wathlingen is recorded and discussed.

A. J. M.

**Ultrabasic rocks of E. Transbaikalia.** I. V. LUCHIZKI (Compt. rend. Acad. Sci. U.R.S.S., 1938, 19, 169—171).—Peridotite from a serpenitic dyke on the bank of the Sredniaya river is described and a chemical analysis recorded.

L. S. T.

**Average chemical composition of the Cambrian basaltic lavas of W. Siberia.** V. K. MONICH (Compt. rend. Acad. Sci. U.R.S.S., 1938, 19, 173—175).—Chemical analyses are recorded and compared with those of related world types. Certain chemical peculiarities are pointed out.

L. S. T.

**Origin of some white earths from the Valle del Nestore (Umbria).** P. PRINCIPI (Atti R. Accad. Lincei, 1938, [vi], 27, 113—116).—The deposits, which have  $\text{SiO}_2$  13.21,  $\text{CaCO}_3$  84.98,  $\text{Fe}_2\text{O}_3 + \text{Al}_2\text{O}_3$  1.42%,  $\text{MgCO}_3$  traces,  $p_H$  7.6, are described.

O. J. W.

**Slovakian infusorial earth.** J. MATĚJKA (Zprávy českoslov. keram. Spol., 1935, 12, 14—39; Chem. Zentr., 1936, ii, 1878).—The properties and possible uses of infusorial earth from Dúbravica ( $\text{SiO}_2$  74.16,  $\text{Al}_2\text{O}_3$  14.14,  $\text{Fe}_2\text{O}_3$  2.19, loss on ignition 8.13%) are described. The behaviour of the earth as an addition to mortar has also been investigated.

L. S. T.

**Pre-Cambrian mining areas in northern Australia.** E. C. ANDREWS (Econ. Geol., 1938, 33, 125—135).—Geological structures of Tennant Creek and Claudie River Au fields are described.

L. S. T.

**Paragenesis of pyrrhotite.** R. BLANCHARD (Econ. Geol., 1938, 33, 218—225).—A criticism (cf. A., 1937, I, 270).

L. S. T.

**Origin of primary lead ores.** R. C. WELLS (Econ. Geol., 1938, 33, 216—217).—A crit. discussion (cf. A., 1938, I, 163, 283).

L. S. T.

**Bromyrite from Tombstone, Arizona.** C. A. RASOR (Amer. Min., 1938, 23, 157—159).—Modes of occurrence of the bromyrite, Ag 56.7, Br 38.9, I 2.6, Cl 0.6, total 98.8%, are described.

L. S. T.

**Presence and constitution of ferruginous concretions in a Mediterranean soil.** P. BOISCHOT and G. DROUINEAU (Compt. rend., 1938, 206, 1577—1579).—A soil from the forest of Valbonne (Maritime Alps) is described, and the occurrence of numerous small balls (0.4—3 mm. diameter), containing considerably more Fe and Mn and less  $\text{Al}_2\text{O}_3$ ,  $\text{TiO}_2$ , and  $\text{SiO}_2$  than the surrounding clay, is discussed.

A. J. E. W.

**Changes of the water-soluble inorganic matters of mud during its keeping and preparation for analysis.** N. VESELOVSKI and M. KONAREV (Hydro-Chem. Mat., 1938, 10, 215—238).— $[\text{SO}_4^{4-}]$  and  $[\text{HCO}_3^-]$  of the mud increase with time.

J. J. B.

**Soils in regions drained by [certain] lakes in the basin of West Manich.** I. A. SCHULGA (Hydro-Chem. Mat., 1938, 10, 29—91).—The mutual relationship between rain- $\text{H}_2\text{O}$ , lake- $\text{H}_2\text{O}$ , and soil is discussed.

J. J. B.

**Determination of refractive indices of vitrains.** T. T. QUIRKE and L. C. MCCABE (Bull. Geol. Soc. Amer., 1938, 49, 669—681; cf. A., 1938, I, 284).—Vals. of  $n$  for various samples of vitrain have been determined with an accuracy of 0.015 from goniometric measurements of the angle of max. polarisation in reflected light. In banded coals  $n$  indicates the rank of the coal, and its approx. B.Th.U. val. on a moist mineral-matter-free basis.

L. S. T.