

# BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

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

JULY, 1938.

**Sodium in the high atmosphere.** R. BERNARD (*Nature*, 1938, 141, 788).—Photographs of twilight spectra and the night sky spectrum, and interference photographs of the yellow radiation, prove the existence of Na in the high atm. L. S. T.

**Intensities and displacements of interstellar lines.** P. W. MERRILL and R. F. SANFORD (*Astrophys. J.*, 1938, 87, 118—132).—The intensity ratio of the  $D_2$  line of Na to the  $K$  line of Ca is approx. 1.6, which indicates approx. three times as many atoms of singly-ionised Ca as of neutral Na. L. S. T.

**Nuclear moment of aluminium.** M. HEYDEN and R. RITSCHL (*Z. Physik*, 1938, 108, 739—747).—Hyperfine structure measurements of some lines in the spark emission spectrum (Al II) give the nuclear spin of Al as 5/2, and the magnetic moment  $3.7 \pm 0.3$  nuclear magnetons (cf. A., 1937, I, 485). L. G. G.

**Predissociation of sulphur.** W. LÖCHTE-HÖFT-GREVEN (*Z. Physik*, 1938, 109, 147—149).—A reply to Olsson's remarks on the effect of pressure on the predissociation region (cf. A., 1938, I, 107). H. C. G.

**Predissociation of sulphur.** E. OLSSON (*Z. Physik*, 1938, 109, 149; cf. preceding abstract).—Further discussion of the matter. H. C. G.

**I II, I I, and Cl II spectra.** K. MURAKAWA (*Z. Physik*, 1938, 109, 162—174).—Identification and classification of the term schemes of I II, I I, and Cl II are given. L. G. G.

**Hyperfine structure, Zeeman effect, and isotope shift in the resonance lines of potassium.** D. A. JACKSON and H. KUHN (*Proc. Roy. Soc.*, 1938, A, 165, 303—312).—The intensity ratio of the components of the resonance lines of  $^{39}\text{K}$  was measured by the method of absorption in an at. beam. The observed val. 1.45 agrees with that required by the spin, 3/2, if allowance is made for overlapping by the lines of the rarer isotope 41. The long- $\lambda$  component is the stronger, showing that the nuclear magnetic moment of  $^{39}\text{K}$  is positive. By use of three at. beams in series the lines of  $^{41}\text{K}$  were resolved; its magnetic moment is also positive. The Zeeman effect was investigated and the observed positions of the lines were found to be in close agreement with those required by quantum theory. G. D. P.

**Measurement of spectral intensities by comparison with total radiation.** T. N. PANAY (*Ann. Physique*, 1938, [xi], 9, 408—476).—The construction of an emitter of total radiation (a black body consisting of an electrically heated C tube in an atm. of A) for the measurement, by comparison, of the

spectral intensity distribution of a no. of sources at various temp. is described. To obtain black bodies at fixed temp. the b.p. of metals are utilised. Results for the relative energy distribution of the continuous spectrum emitted by K in a flame are reported. The curve shows a min. for  $\lambda$  5210 and a max. for  $\lambda$  4430, with continuous decrease in the violet and ultra-violet. Total radiation in the visible and ultra-violet has been calc. for use with the Wien or Planck formulae. A correction for the study of line spectra is given. N. M. B.

**Equivalent widths and the temperature of the solar reversing layer.** D. H. MENZEL, J. G. BAKER, and L. GOLDBERG (*Astrophys. J.*, 1938, 87, 81—101).—The mean excitation temp. of the solar reversing layer calc. from lines of Ti I is  $4400^\circ \pm 100^\circ$ . L. S. T.

**Spark spectrum of iron, 5016—7712 Å., with identifications of Fe II lines in the solar spectrum.** A. S. KING (*Astrophys. J.*, 1938, 87, 109—117).—The spectrum of Fe from a strong spark discharge gave 127 lines ( $\lambda$  given) in the region  $>5000 \text{ Å.}$ , due mainly to Fe II. The lines measured in the spark spectrum include some which are prominent in the spectra of nova. L. S. T.

**Action cross-sections for impacts of the second type in excited mercury vapour: hyperfine structure of the 2537 Å. mercury resonance line.** O. BUHL (*Z. Physik*, 1938, 109, 180—203). L. G. G.

**Optical investigation of a metal vapour discharge. V. Cumulative excitation of atoms in a low-pressure mercury discharge.** V. FABRIKANT, F. BUTAEVA, and I. ZIRG (*Physikal. Z. Sovietunion*, 1938, 13, 23—31; cf. A., 1937, I, 104, 158; 1938, I, 165).—The concn. of atoms in the  $6^3P_{0,1,2}$  states during a discharge in Hg at a const. pressure of  $10^{-3} \text{ mm.}$   $\propto$  the electron concn. ( $c$ ). In the excitation of the  $7^3S_1$  state the no. of cumulative excitations  $\propto c^2$ . Reabsorption has a considerable effect on the increase in intensity of the individual lines with increasing current. J. W. S.

**Improved description of the thorium spectrum.** M. FRED (*Astrophys. J.*, 1938, 87, 176—197).—Part of the Th spectrum has been separated into approx. 750 Th I lines and 2000 Th II lines, the most important of which are tabulated. Certain of the lines of each spectrum are designated as low-temp. lines. The data are sufficient for the term analysis of Th I. L. S. T.

**Ultra-violet absorption spectra of some early-type stars.** W. S. ADAMS and T. DUNHAM, jun. (*Astrophys. J.*, 1938, 87, 102—108).—Measurements of absorption lines of two O-type and six B<sub>0</sub>- to B<sub>2</sub>-type stars are recorded for the region 3050—3400 Å. Prominent elements are O II, O III, Si III, Si IV, S III, S IV, Ne II, He I, He II, and N II. L. S. T.

**Very brilliant source of light.** G. VAUDET (*Ann. Physique*, 1938, [xi], 9, 645—722).—The production of a brilliant light of short duration by the explosion in air or vac. of a thin metal wire (Cu, Fe, Al, Zn, W) by a heavy current is described. The temp. may exceed 20,000°, and the duration of the light is 10—20 × 10<sup>-6</sup> sec. The spectrum of the light emitted, λλ 5000—1000, was studied. The presence of all possible ionised states was shown. An explanation of the formation of continuous spectra is offered, and applications of the method to the production of intense magnetic fields, the determination of the c.d. in a discharge, and the ultra-microscopy of rapidly moving particles and mols. are indicated. A. J. M.

**Intensity of spectral lines in an arc with carbon electrodes.** S. L. MANDELSTAM (*Compt. rend. Acad. Sci. U.R.S.S.*, 1938, 18, 559—563).—The effect of large amounts of NaCl or KCl on the intensities of the spectral lines of elements present in traces in the C arc is attributed to the lowering of the temp. of the arc. The effect is analysed with the aid of the Saha formula, and observed results are in qual. agreement with the theory. F. J. G.

**Accuracy of the spin maintenance law.** K. GAILER (*Physikal. Z.*, 1938, 39, 407—409).—An attempt has been made to test the electron spin maintenance law experimentally in the case of excitation by at. collision, the kinetic energy of the colliding atoms being considerably > their excitation energies. The collision of He with Be, Mg, Ca, and Sr atoms was investigated. In all cases triplet excitation of the alkaline-earth atoms was observed without simultaneous excitation of the He atoms. This appears to be contrary to the electron spin maintenance law, but may agree with it if metastable He atoms are present. A. J. M.

**Effect of gases on the width and position of spectral lines.** P. SCHULZ (*Physikal. Z.*, 1938, 39, 412—429).—A comprehensive review of theoretical and experimental work. A. J. M.

**Possibility of measuring the transverse Doppler effect.** O. SCHERZER (*Ann. Physik*, 1938, [v], 32, 242—244).—Theoretical. H. C. G.

**g-Values of d-electron-containing configurations of the rare gas terms.** K. LÖRINCZI (*Z. Physik*, 1938, 109, 175—179).—g-Vals. of the p<sup>5</sup>d terms are calc. from the energy matrices and compared with those obtained from observations on the Zeeman effect of certain A I and Kr I lines. L. G. G.

**Behaviour of the frequency and polarisation of Stark effect components under sudden alteration of field conditions.** R. GEBAUER (*Z. Physik*, 1938, 109, 85—107).—The Stark effect with H<sub>β</sub> and H<sub>γ</sub> has been examined in rapidly changing fields. It is found that the time of observation exceeds a certain

limiting val. for the effect to be observable. This result may be derived from the Heisenberg uncertainty principle. H. C. G.

**Intensity ratios of Stark effect components of hydrogen lines. I. Intensity dissymmetry dependent on field strength.** N. RYDE (*Z. Physik*, 1938, 109, 108—120; cf. A., 1937, I, 485).—Intensity ratios of the Stark effect components of H<sub>α</sub> and H<sub>β</sub> have been examined by the canal ray method with field strengths up to 500 kv. per cm. The distribution of atoms among the different Stark effect levels is discussed. H. C. G.

**Coefficient of volume ionisation for pure neon and neon-argon mixtures.** I. I. GLOROV (*Physikal. Z. Sovietunion*, 1938, 13, 84—102; cf. A., 1938, I, 165).—The theoretical vol. ionisation coeffs. (α) for pure Ne and Ne-A mixtures are in qual. accord with experiments. The addition of <5 × 10<sup>-4</sup>% of A to Ne scarcely changes α, but additions >5 × 10<sup>-4</sup>% increase it many times, owing to increased ionisation of admixed atoms by metastable Ne atoms. When the [A] is >0.3% energy losses of electrons cause a decrease in the most probable electron velocity and hence a decrease of α. The results are applied to interpretation of observations on the Townsend discharge. J. W. S.

**Sensitivity of the balanced space charge method for detecting ionisation of gases by collision of ions and atoms.** (A) A. ROSTAGNI. (B) R. N. VARNEY (*Physical Rev.*, 1938, [ii], 53, 729—731, 732—734).—(A) Factors which influence the method are discussed critically with special reference to the results of Varney on A, Ne, and He (cf. A., 1935, 556; 1936, 1041).

(B) Additional information is given on the reaction of the detector to fast positive ions in the presence of gas in the tube. The sensitivity of the detector is analysed, primarily in terms of observations, and further notes on mechanism are given. N. M. B.

**Application of transverse field methods to the measurement of ionisation and charging cross-sections.** E. PERSICO and A. ROSTAGNI (*Ann. Physik*, 1938, [v], 32, 245—252).—Conditions limiting the accuracy of the various methods employing transverse electric fields for the measurement of the ionisation and charging cross-sections of atoms and mols. are discussed. H. C. G.

**Duration of counter tube impulses.** J. M. LYSHEDE and J. C. MADSEN (*Z. Physik*, 1938, 108, 777—779).—The forced quenching of counter tubes with rhythmically applied voltage impulses is used to study the duration of the tube discharge. It is shown that the tube potential must fall below a threshold val. and remain there for a definite time to cause quenching. This controls the max. no. of impulses recordable per sec. L. G. G.

**Ion layer around a probe in a low-pressure discharge.** V. POLIN and S. GVOZDOVER (*Physikal. Z. Sovietunion*, 1938, 13, 47—54).—The density distribution of primary high-velocity electrons around an incandescent W filament acting as probe electrode in a Hg-vapour discharge has been studied. An

increase in the ionic current to the probe renders its ionic layer more symmetrical. J. W. S.

**Dependence of the coefficient of the secondary emission on the angle of incidence of the primary beam.** S. J. LUKJANOV (Physikal. Z. Sovietunion, 1938, 13, 123—126; cf. J. Exp. Theor. Phys., 1937, 7, 856).—The formula deduced previously is applicable to Müller's data (A., 1937, I, 209). J. W. S.

**Oxide-coated cathodes. I. Particle size and thermionic emission.** M. BENJAMIN, R. J. HUCK, and R. O. JENKINS (Proc. Physical Soc., 1938, 50, 345—357).—The emission from an oxide cathode increases as the particle size of the oxide decreases; the smaller particles give a more uniform emitting surface and increase the ratio of emitting to non-emitting areas. A tabulation of various methods of prep., with X-ray analysis of constitution and structure, shows that the size of the oxide particles is determined by the method of prep. of the carbonates. N. M. B.

**Field electron emission at thin insulating layers of the Al-Al<sub>2</sub>O<sub>3</sub>-Cs<sub>2</sub>O type.** J. MÜHLENFORDT (Z. Physik, 1938, 108, 698—713).—Secondary emission at Al-Al<sub>2</sub>O<sub>3</sub>-Cs<sub>2</sub>O cathodes in vac. may be excited by positive gas ions as well as fast electrons. The presence of inert gases at low pressure causes sp. variation in the type of emission, which is also temp.-dependent. L. G. G.

**Electron liberation through impact of positive ions on the cathode in a glow discharge. II. Influence of cathode surface conditions.** A. GÜNTHER-SCHULZE and H. BETZ. **III. Bends and breaks in the  $\gamma$  curves and their meaning.** A. GÜNTHER-SCHULZE and A. BÄR (Z. Physik, 1938, 108, 780—785; 109, 121—126; cf. A., 1938, I, 109).—II. The formation of films, especially oxide films, on cathodes of K, Mg, Al, Cu, Fe, Ag, and Pt has a pronounced effect on the liberation of electrons by impact of positive ions. With Mg at 2000 v. electron liberation is increased five-fold by formation of an oxide film. Formation of oxide or hydride films may be followed by this means.

**III. Bends in  $\gamma$  curves (slope decreasing) have two causes.** (1) At low cathode voltages emission arises from the oxide layer and is  $>$  that from the metal. As the voltage rises the oxide layer is removed by cathode sputtering, leaving bare metal. (2) At cathode voltages  $>$   $\sim$  3000 v. positive ions penetrate to the inner layers of the cathode and the liberated electrons fail to escape from the metal. H. C. G.

**Motion of electrons in an alternating electric field.** K. S. KNOL, M. J. O. STRUTT, and A. VAN DER ZIEL (Physica, 1938, 5, 325—334).—In certain multigrad valves the application of suitable steady and alternating high-frequency potentials results in some electrons having a kinetic energy  $>$  corresponds with the instantaneous val. of the potential in their locality. An expression for this energy, calc. from the equations of motion, is discussed and applied to special cases. Comparison with experiment is satisfactory. A new way of rectifying high-frequency a.c. is described. T. H. G.

**Theory of pressure-ionisation and its applications.** D. S. KOTHARI (Proc. Roy. Soc., 1938, A, 165, 486—500).—The theory predicts that the material in the interior of the white dwarf stars should be fully ionised and that there should be a max. radius (approx. that of planet Jupiter) for a body in which the electrons constitute a degenerate gas. The theory shows that Jupiter and Saturn have cores of metallic H. The planets Mercury, Venus, Earth, and Mars have cores of much heavier material, possibly Fe. G. D. P.

**Formation of negative ions at surfaces.** R. H. SLOANE and R. PRESS (Nature, 1938, 141, 872—873).—Experiments showing that bombardment of metal surfaces with positive ions, presumably Hg<sup>+</sup>, produces light negative ions possessing excess energy are described. A major cause of the production of these ions appears to be sputtering of persistently occluded electronegative films by bombardment with positive ions. L. S. T.

**Transport of ions by a gaseous current. Expansion of an ionised gaseous current.** (MME.) M. MOREAU-HANOT (Compt. rend., 1938, 206, 1168—1170).—An expression is derived for the limiting current carried by a stream of gaseous ions moving with const. velocity through a tube of insulating material. Measured vals. are in approx. agreement, but decrease more rapidly than the calc. vals. with increasing tube length, and increase less rapidly with increasing velocity of the ion stream. A. J. E. W.

**Formation of isotope  $^3\text{He}$ .** F. JOLIOT and I. ZLOTOWSKI (Compt. rend., 1938, 206, 17, 1256—1259; cf. A., 1938, I, 290).—Deuterons and protons were observed when a paraffin wax target was bombarded with  $\alpha$ -particles. Energy calculations show that the protons are formed by  $^4\text{He} + ^2\text{H} \rightarrow ^3\text{He} + ^1\text{H} + Q$ . The  $^3\text{He}$  nucleus is stable with respect to neutron emission. Natural sources of He contain very little  $^3\text{He}$ . J. A. D.

**Isotopic constitution of gadolinium, dysprosium, erbium, and ytterbium.** A. J. DEMPSTER (Physical Rev., 1938, [ii], 53, 727—728).—The mass spectra photographed by the use of a spark source for the ions reveal the following new isotopes with their approx. % abundance:  $^{154}\text{Gd}$  (1.5),  $^{152}\text{Gd}$  (0.2),  $^{160}\text{Dy}$  (1.5),  $^{158}\text{Dy}$  (0.1),  $^{164}\text{Er}$  (2),  $^{162}\text{Er}$  (0.25),  $^{170}\text{Yb}$  (2),  $^{168}\text{Yb}$  (0.06) (cf. Pool, A., 1938, I, 291). N. M. B.

**Eighth report of the Atomic Weight Commission of the International Union for Chemistry.** G. P. BAXTER, O. HÖNIGSCHMID, and P. LEBEAU (Ber., 1938, 71, [A], 93—105).—The report covers the period from 30th September, 1936, to 30th September, 1937. The following changes are recommended: H, 1.0078 to 1.0081; He, 4.002 to 4.003; C, 12.01 to 12.010; Mo, 96.0 to 95.95; Er, 167.64 to 167.2; W, 184.0 to 183.92; Os, 191.5 to 192. H. W.

**Energy-range relations for deuterons, protons, and  $\alpha$ -particles.** F. T. ROGERS, jun., and (MRS.) M. M. ROGERS (Physical Rev., 1938, [ii], 53, 713—714).—Complete available data (Bethe, A., 1938, I, 172) are presented as a set of 11 equations. N. M. B.

**Form of the  $\beta$ -spectrum of Ra-E in the vicinity of the upper limit and the mass of the neutrino.** A. I. ALICHANIAN, A. I. ALICHANOV, and B. S. DJELEPOV (Physical Rev., 1938, [ii], 53, 766—767; cf. A., 1938, I, 168).—Using the method of electron focussing in a uniform magnetic field, the spectrum was investigated near the upper limit. Results and curves obtained from the Konopinski-Uhlenbeck theory are given, and satisfactory agreement is obtained (cf. Lyman, A., 1937, I, 107). N. M. B.

**Shape of the  $\beta$ -spectrum of Th-C and the mass of the neutrino.** A. I. ALICHANIAN and S. J. NIKITIN (Physical Rev., 1938, [ii], 53, 767; cf. preceding abstract).—The shape of the spectrum, investigated by the magnetic focussing method, is similar to that of Ra-E, and is in close agreement throughout with the Konopinski-Uhlenbeck curve. N. M. B.

**Directional distribution of  $\beta$ -ray processes.** I. I. PREDMESTNIKOV (Physikal. Z. Sovietunion, 1938, 13, 32—35).—Mathematical. J. W. S.

**$\beta$ -Spectrum of radioactive substances.** E. F. M. VAN DER HELD (Physica, 1938, 5, 430—432).—Neither the theory of Fermi nor that of Konopinski and Uhlenbeck on the energy distribution in the  $\beta$ -spectrum agrees perfectly with experimental results but a linear combination of the two should and apparently does agree much better. Two such linear expressions are deduced; the gradient of the first  $\propto$  at. no., while the second intersects the  $W$ -axis at the same point as Kurie's function  $\sqrt{N/f}$ . T. H. G.

**Absorption and diffusion of  $\beta$ -rays in cellulose acetate.** R. ARNOULT (J. Phys. Radium, 1938, [vii], 9, 145—148).—The absorption curves of electrons from active thoron in cellulose acetate have been measured, with the use of a magnetic focussing method to obtain beams of uniform energy. O. D. S.

**Absorption of  $\beta$ -rays of radioactive elements.** M. E. NAHMAS and L. I. SCHIFF (J. Phys. Radium, 1938, [vii], 9, 140—144).—An exact method for the measurement of the absorption curves of  $\beta$ -rays has been developed and gives vals. for the max. energy of the  $\beta$ -rays agreeing with those obtained by other methods. A  $\gamma$ -radiation with energy of the order 100 e.kv. accompanies the  $\beta$ -emission of radioactive Ag (22 sec.) to the extent of  $> 10$  quanta per  $\beta$ -particle emitted. O. D. S.

**$\gamma$ -Ray activity induced in cadmium by slow neutron bombardment.** S. NAKAGAWA and I. SUMOTO (Proc. Imp. Acad., Tokyo, 1938, 14, 106—107).—Cd has been bombarded, both directly and in a paraffin block, by neutrons from Rn-Be and Be + D. In addition to the usual  $\beta$ -ray activity,  $\gamma$ -ray activity has been observed and suggests that there is produced a Cd isotope of 45 min. period which emits fairly strong  $\gamma$ -rays of energy  $10^6$  e.v., but very weak or no  $\beta$ -rays. Ag and Mo filters showed no selective absorption indicative of  $K$  radiation from an element such as Ag. T. H. G.

**Production of gamma-rays by neutrons.** E. H. S. BURHOP, R. D. HILL, and A. A. TOWNSEND (Proc. Roy. Soc., 1938, A, 165, 116—132).—Curves

of absorption in B of those neutrons which excite  $\gamma$ -rays in Ag, Cd, As, Sb, I, and Hg are experimentally investigated. For non-thermal neutrons the curves are interpreted in two parts: (i) associated with a nuclear resonance level corresponding with a very small neutron energy, (ii) due to neutrons captured into resonance levels of greater energy. Additional measurements on Ag were made for those neutrons which excite  $\beta$ -radiations. The identity of the energy levels which give rise to  $\gamma$ - and to  $\beta$ -radiation in the same nucleus is discussed. G. D. P.

**Emission of an ionising radiation by dried vegetable matter.** F. ARTIGAS (Compt. rend., 1938, 206, 1200—1202; cf. A., 1938, I, 112).—Radioactivity due to K has been detected in tobacco, and in dried colza flowers and parsnip foliage. A. J. E. W.

**Uranium-Z and the problem of nuclear isomerism.** N. FEATHER and E. BRETSCHER (Proc. Roy. Soc., 1938, A, 165, 530—551).—The radiations from U-Z have been examined by the absorption method using a tube counter. A scheme of energy levels is put forward to account for the facts and the isomerism of the nuclei U-X<sub>2</sub> and U-Z is discussed. It is concluded that U-Z is formed from U-X<sub>2</sub> in a  $\beta$ - $\gamma$  branching, rather than from U-X<sub>1</sub> directly in a  $\beta$ - $\beta$  transformation. G. D. P.

**Energy and intensity of photoneutrons from beryllium and from the deuteron.** H. VON HALBAN, jun. (Compt. rend., 1938, 206, 1170—1172).—Production of neutrons by bombardment of D and Be by  $\gamma$ -rays from radio-Th and Ra has been investigated. The effective cross-sections for  $\gamma$ -rays of 2.64 Mev. energy from radio-Th are: D,  $10 \pm 0.8 \times 10^{-28}$ ; Be,  $3.1 \pm 0.4 \times 10^{-28}$  sq. cm. The intensity distributions of the neutrons obtained using the radio-Th and Ra  $\gamma$ -ray sources are identical, indicating that Ra emits  $\gamma$ -rays of approx. energy 2.6 Mev. Ra-Be sources produce neutrons of widely varying energy. The proportions of Ra and radio-Th in MsTh may be determined from the neutron yields with D and Be. Be in alloys may be determined similarly, using a Ra or radio-Th source. A. J. E. W.

**Scattering of slow neutrons in a crystal lattice.** I. POMERANTSCHUK (Physikal. Z. Sovietunion, 1938, 13, 65—83).—Mathematical. J. W. S.

**Fast neutrons.** M. L. POOL (Physical Rev., 1938, [ii], 53, 707—710).—The distribution of fast neutrons about the Li + D source, investigated by means of radioactivity induced in Ag (24.5 min.) and Al (14.8 hr.), is roughly in agreement with that calc. from statistical considerations. The max. neutron energy is 20.8 M.e.v. Sources and energies of neutrons producing various reactions are examined. N. M. B.

**Magnetic properties of free neutrons.** O. R. FRISCH, H. VON HALBAN, jun., and J. KOCH (Physical Rev., 1938, [ii], 53, 719—726).—A detailed account of results previously reported (cf. A., 1937, I, 340, 441, 543). Investigations indicate that the magnetic moment of the neutron is approx.  $2 \times 1/1840$  Bohr magneton and the sign is negative. The field accounting for the observed rate of precession of neutrons inside magnetised Fe is  $> 100$  times the actual

field strength  $H$  and actually of the order of magnitude of the magnetic induction  $B$ . N. M. B.

**Formation of an excited  $^3\text{He}$  in the disintegration of deuterium by deuterons.** T. W. BONNER (Physical Rev., 1938, [ii], 53, 711—713; cf. A., 1938, I, 6).—Observation of the energy distribution of the neutrons from the reaction  $^2\text{H} + ^2\text{H} \rightarrow ^3\text{He} + n' + Q_1$  shows two homogeneous neutron groups with energies 1.08 and 2.50 M.e.v. at  $90^\circ$  to the 0.11 M.e.v. deuterons. The probability ratio is 1:10. The corresponding vals. of  $Q_1$  are  $3.29 \pm 0.08$  and  $1.40 \pm 0.11$  M.e.v. The low-energy group results when the  $^3\text{He}$  is left excited to a level of  $1.89 \pm 0.11$  M.e.v. The mass of  $^3\text{He}$ , calc. from the val. of  $Q_1$  and the mass-spectrographic val. of  $^2\text{H} = 2.01473$ , is  $3.01700$ , indicating that  $^3\text{H}$  may disintegrate spontaneously into  $^3\text{He}$  with emission of an electron. N. M. B.

**Identification and measurement of helium formed in beryllium by  $\gamma$ -rays.** E. GLÜCKAUF and F. A. PANETH (Proc. Roy. Soc., 1938, A, 165, 229—238).—A microchemical method for the determination of He in Be is described. It is concluded that the disintegration product of Be, which emits neutrons when irradiated by  $\gamma$ -rays, is two atoms of He and not the isotope of Be of mass 8. G. D. P.

**Occurrence of helium in beryls.** J. W. J. FAY, E. GLÜCKAUF, and F. A. PANETH (Proc. Roy. Soc., 1938, A, 165, 238—246; cf. preceding abstract).—Various specimens of old Be metal have been analysed for He. It is concluded that the spontaneous production of He is  $< 1.3 \times 10^{-11}$  c.c. per g. per year. It follows that the He content of beryls cannot be due to disintegration of  $^8\text{Be}$ , nor can it be ascribed to the influence of natural sources of  $\gamma$ -rays. As Be does not itself produce adequate amounts, the He content of beryls must be ascribed to some other element. G. D. P.

**Deuteron-induced radioactivity in oxygen.** T. YASAKI and S. WATANABE (Nature, 1938, 141, 787).—Bombardment of  $\text{O}_2$  and several oxides ( $\text{CO}_2$ ,  $\text{WO}_3$ , and  $\text{H}_2\text{O}$ ) with 2 M.e.v. deuterons gives  $^{17}\text{F}$  with a period of 1.5 min., and  $^{18}\text{F}$  with one of 120 min. The upper limit of the energy of the positrons emitted from the latter isotope is  $0.7 \pm 0.05$  M.e.v. Possible nuclear reactions by which it may be formed are discussed. L. S. T.

**Artificial activity of radio-aluminium ( $^{26}\text{Al}$ ) and radio-chlorine ( $^{34}\text{Cl}$ ).** H. BRANDT (Z. Physik, 1938, 108, 726—738).—A theoretical and practical study of the production of  $^{26}\text{Al}$  and  $^{34}\text{Cl}$  by  $\alpha$ -particle bombardment of Na and P. L. G. G.

**Preparation of radio-element  $^{32}\text{P}$  in weighable quantity by means of an electric field.** J. GOVAERTS (Nature, 1938, 141, 871).—By irradiation of  $\text{CS}_2$  for 9 days with neutrons from a Ra + Be source in presence of an electric field of 70—90 v., the  $^{32}\text{P}$  produced is conc. almost entirely on the brass or Cu anode, which is covered with a black deposit of phosphide (?); the increase in wt. was 3.7 mg. L. S. T.

**Radio isotopes of nickel.** J. J. LIVINGOOD and G. T. SEABORG (Physical Rev., 1938, [ii], 53, 765).—Ni bombarded for 4 hr. by 100  $\mu\text{amp.}$  of 5.5 M.e.v.

deuterons yields  $^{63}\text{Ni}$  ( $2.6 \pm 0.03$  hr.) emitting negative electrons and  $\gamma$ -rays;  $^{61}\text{Cu}$  is also produced (cf. Thornton, A., 1937, I, 439). Fe exposed to several  $\mu\text{amp.}$ -hr. of bombardment with He ions at 12.6 and at 16 M.e.v. gives rise to  $^{57}\text{Ni}$ , a new isotope of half-life  $36 \pm 2$  hr., emitting positrons and a  $\gamma$ -ray, probably annihilation radiation. N. M. B.

**Concentration of radioactive copper by use of a high-speed rotating cathode.** J. STEIGMAN (Physical Rev., 1938, [ii], 53, 771).—The prep. of radioactive Cu (12.8 hr.) and its separation from solution by means of a high-speed rotating cathode are described, and operating conditions discussed. High concn. is obtained without the necessity of adding an inactive isotope as a carrier. N. M. B.

**Artificial radioactivity produced by protons.** L. N. RIDENOUR, L. A. DELSASSO, M. G. WHITE, and R. SHERR (Physical Rev., 1938, [ii], 53, 770).—Ni, Cu, Mg, and Ag became strongly radioactive after bombardment with about 1  $\mu\text{amp.}$  of protons at 3.8 M.e.v., accelerated by a cyclotron. Ni gave four periods:  $80 \pm 2$  sec.,  $7.9 \pm 0.6$  min.,  $3.4 \pm 0.1$  hr., and  $12.8 \pm 0.3$  hr.; the relative intensities and probable interpretations are 3:1:31:35, and  $^{58}\text{Cu}$ ,  $^{60}\text{Cu}$ ,  $^{61}\text{Cu}$ ,  $^{64}\text{Cu}$ , respectively. Each of the first three emits positrons, and  $^{64}\text{Cu}$  emits electrons and positrons. Cu gives rise to  $^{63}\text{Zn}$  of half-life  $38 \pm 1$  min., emitting positrons. Mg gives  $^{24}\text{Al}$  or  $^{25}\text{Al}$  ( $20 \pm 2$  min.) emitting positrons; there is also a weaker unidentified activity of some hr. half-life. Ag gives a weak activity of a few min. half-life, and a strong activity,  $^{107}\text{Cd}$  or  $^{109}\text{Cd}$  ( $6.67 \pm 0.06$  hr.), emitting electrons which are provisionally regarded, not as disintegration electrons, but as photo-electrons ejected by a  $\gamma$ -radiation which follows extranuclear electron capture by the unstable Cd isotope. A weak radiation is probably Ag K $\alpha$  radiation, the production of which is interpreted. N. M. B.

**Artificially radioactive arsenic.** P. HARTECK, F. KNAUER, and W. SCHAEFFER (Z. Physik, 1938, 109, 153—161).—The  $\beta$ -decay of radioactive As, deposited on thin Al foil, was measured by photographing a large no. of tracks in an automatic Wilson chamber. Energy distribution was obtained by application of a magnetic field to the tracks, and the  $\beta$ -spectrum yields two components of limiting energies  $3.16 \pm 0.10$  M.e.v. and  $1.10 \pm 0.20$  M.e.v. The significance of these is discussed and a term scheme for  $^{76}\text{Se}$  is derived. L. G. G.

**Isomeric forms of radio-rhodium.** B. PONTECORVO (Nature, 1938, 141, 785—786).—The ratio of the initial intensities of the radioactive forms of Rh with periods of 44 sec. and 4.2 min., obtained by bombardment of Rh with neutrons, have been deduced from the total activity (i) with a source of Rn + Be in presence of paraffin; (ii) with Rn + Be placed on the axis of the cylinder of Rh in absence of paraffin and H media. The vals. are  $11 \pm 0.7$  and  $6 \pm 0.5$ , respectively. L. S. T.

**New radioactive silver isotope with long half-life period.** H. REDDEMANN and F. STRASSMANN (Naturwiss., 1938, 26, 187—188).—In addition to the Ag isotopes with half-life 2.3 min. and 23 sec., re-

spectively, four others with half-life periods 24.5 min., 8.2 days, 7.5 days, and 3.2 hr. have been discovered.  $^{108}\text{Ag}$  occurs in two isomeric forms, one of which loses a positron and has a half-life period of 24.5 min. whilst the other loses an electron, and has a half-life of 8.2 days. Both are obtained by irradiation of Ag with rapid neutrons ( $\text{Li} + \text{D}$ ), the process being  $^{107}\text{Ag}(n, 2n)^{106}\text{Ag}$ , and by bombardment with Ra-Be neutrons. Long irradiation with slow Ra-Be neutrons gives rise to a further isotope (an isomeric form of  $^{108}\text{Ag}$  or  $^{110}\text{Ag}$ ) with a half-life of  $190 \pm 40$  days.

A. J. M.

**Long-period radioactivity in silver, caesium, and indium activated by slow neutron bombardment.** K. ALEXEEVA (Compt. rend. Acad. Sci. U.R.S.S., 1938, 18, 553—555).—Ag, Cs, and In, after bombardment with slow neutrons, exhibit radioactivity with half-life periods of 1.5—2 years,  $< 1$  year, and  $60 \pm 10$  days, respectively.

F. J. G.

**Heavy electrons and theories of nuclear processes.** G. WENTZEL (Naturwiss., 1938, 26, 273—279).—Arguments in favour of the existence of heavy electrons based on the consideration of the penetrating component of cosmic radiation, proton-neutron force, and  $\beta$ -disintegration are reviewed. The theory of Yukawa and the phenomenon of showers are also dealt with.

A. J. M.

**Heavy electrons in cosmic rays.** E. J. WILLIAMS and E. PICKUP (Nature, 1938, 141, 836).—A correction (cf. A., 1938, I, 291).

L. S. T.

**New analysis of cosmic radiation including the hard component.** L. W. NORDHEIM (Physical Rev., 1938, [ii], 53, 694—706).—A representation of all known data on cosmic-ray intensities in their dependence on geomagnetic latitude and on altitude (and depth below sea level) is obtained on the assumption of hard and soft components with specified properties.

N. M. B.

**Nature of the penetrating component of cosmic rays.** P. M. S. BLACKETT (Proc. Roy. Soc., 1938, A, 165, 11—31).—Measurement of the energy loss in plates of Pb and Au shows that most rays with  $E < 2 \times 10^8$  e.v. are apparently electronic in character. From a reinterpretation of the data for higher energies it is concluded that the penetrating rays are not normal electrons. Two theories are discussed to explain the facts. In one it is postulated that the particles change their mass during collisions with nuclear fields; in the other, penetrating rays are supposed to have electronic rest mass, but are distinguishable from normal electrons by a property which has the effect of making their radiative energy loss vary with their energy.

G. D. P.

**Scattering of cosmic-ray particles in metal plates.** P. M. S. BLACKETT and J. G. WILSON (Proc. Roy. Soc., 1938, A, 165, 209—215).—Multiple scattering is measured in Pb and Cu plates, the vals. of  $H_p$  extending from  $10^5$  to  $3 \times 10^7$  gauss-cm. The scattering angle is inversely  $\propto H_p$  and is in approx. agreement with theory. The results support the view that it is by their greater rest mass that the penetrating rays are distinguished from radiating electrons.

G. D. P.

**Cosmic rays; barometric effect, variations of the second kind, and disturbances produced by the earth's magnetic field.** W. KOLHÖRSTER (Physical Rev., 1938, [ii], 53, 768—769).—Records for January, 1938, are plotted and discussed.

N. M. B.

**Rate of production of very large cosmic-ray bursts as a function of lead shielding thickness.** W. P. JESSE and R. L. DOAN (Physical Rev., 1938, [ii], 53, 691—693).—Determinations of the frequency of occurrence of very large bursts (120— $> 1000$  particles) as a function of Pb shielding thickness showed that the thickness of Pb for optimum burst rate was approx. 3 cm.

N. M. B.

**Magnetic determination of the energy of cosmic-ray particles.** H. D. RATHGEBER (Z. Physik, 1938, 109, 273—292).—The deviation of the path of cosmic-ray particles by means of a magnetic field in air is studied. A new type of electromagnet is described giving a strong field, well spread out, and capable of producing deviations of  $\sim 1$  cm.

L. G. G.

**Periodic system of the elements.** E. C. PAYNE (J. Chem. Educ., 1938, 15, 180—183).—An octagonal prism is divided into rhombs by a descending helical band and an element is assigned to each rhomb.

L. S. T.

**Atomic volumes.** R. LAUTÉ (Bull. Soc. chim., 1938, [v], 5, 695—701).—The most abundant isotope of an element generally contains an even no. of protons ( $P$ ) in the atom, the only exceptions being  $^9\text{Be}$ ,  $^{14}\text{N}$ , and perhaps  $^{129}\text{Xe}$  and  $^{195}\text{Pt}$ . With the exception of H, which contains no free neutrons, the no. of neutrons ( $N$ ) lies within the limits  $P \gtrsim N < 2P$ . It is deduced that for elements of the same family in the same cryst. state the at. vols. are given approx. by  $V = an^3/P + b$ , where  $n$  is the order of the element in the series and  $a$  and  $b$  are consts. Calc. vals. of  $V$  are in accord with experiment, except in the case of He (cf. A., 1937, I, 349). Since crystal parameters of the elements of the same family are a linear function of the cube root of the parachor [ $P$ ], it is inferred that [ $P$ ] is not  $\propto V$ , but that [ $P$ ]<sup>3</sup> is a linear function of  $V^{\frac{1}{3}}$ . Combined data on the Carlsobn groups permit a revision of the periodic classification.

J. W. S.

**Magnitude of nuclear forces.** G. BECK (Nature, 1938, 141, 832; cf. A., 1938, I, 292).—The interaction const. between heavy particle and heavy electron field is  $[(hc/2\pi)(2m/M)]^{\frac{1}{2}}$ .

L. S. T.

**Neutrino theory of light. II. Three-dimensional case.** A. SOKOLOV (Physikal. Z. Sovietunion, 1938, 13, 36—46; cf. A., 1937, I, 441).—Mathematical.

J. W. S.

**Fundamental unit of electric charge.** H. T. FLINT and W. WILSON (Proc. Physical Soc., 1938, 50, 340—344).—Mathematical. A generalisation of the uncertainty relationships when an electromagnetic field is present. The atomicity of electric charge is a consequence of the integral relationships of the quantum theory.

N. M. B.

**Eddington's fundamental equation.** H. C. CORBEN (Nature, 1938, 141, 747).

L. S. T.

**Effects of electron interaction on energy levels of electrons in metals.** E. WIGNER (Trans. Faraday Soc., 1938, 34, 678—685).—A theoretical discussion. F. L. U.

**Potential in the new electro-dynamics.** Z. CHRAPELYWY (Bull. Acad. Polonaise, 1937, A, 509—520; cf. Meixner, A., 1935, 1050).—Mathematical. The shift in energy levels due to insertion in the wave equation of the potential expression obtained from the Born-Infeld field theory does not remove the discrepancy between theory and experiment in the H spectrum. I. McA.

**Universal constant for band spectra. Attribution of lines in a band to causes other than rotation of the molecule.** H. DESLANDRES (Compt. rend., 1938, 206, 1153—1157).—The application of the formula  $\nu = q\bar{d}_1/s'r'$  (cf. A., 1938, I, 115) to lines hitherto supposed to have vibrational or rotational origin is discussed. Vibrational lines are attributed to interaction between the electrons of one atom or radical with the nucleus of the second, and rotational lines to interactions between the electrons of the two atoms or radicals concerned. The  $\nu$  of a no. of lines in the spectra of H<sub>2</sub>O, HCl, NH<sub>3</sub>, CO, CaF<sub>2</sub>, and H<sub>2</sub> are shown to be in agreement with the above formula. The results indicate that the electrons in an atom are not excited in succession, all the electrons in one level or sub-level being simultaneously excited. A. J. E. W.

**Life time of free CN radical.** J. U. WHITE (J. Chem. Physics, 1938, 6, 294).—The 0,0 band of the  $2\Sigma \rightarrow 2\Sigma$  system of the CN radical at 3883 Å. has been observed by a method which is described. The longest life observed was 0.006 sec. W. R. A.

**Rotational analysis of bands of lead sulphide.** H. BELL and A. HARVEY (Proc. Physical Soc., 1938, 50, 427—435).—Full data are tabulated, with analyses, of the (6,0), (7,0), (9,0), (2,1), (3,1), and (4,1) bands of the  $A \leftarrow X$  system of <sup>208</sup>PbS in absorption, and consts. are evaluated. A no. of lines due to <sup>206</sup>PbS and <sup>207</sup>PbS are recorded. N. M. B.

**Band spectrum of tin monoxide. II.** P. C. MAHANTI and A. K. SEN GUPTA (Z. Physik, 1938, 109, 39—51).—An analysis of the 1,0, 0,0, and 0,1 bands ( $\lambda\lambda = 3323.5, 3388.2, \text{ and } 3484.4$ , respectively) corresponding with a  $1\Sigma \rightarrow 1\Sigma$  transition of the  $A$  system of SnO is given. The lower state is the ground state of the mol., viz., Sn (<sup>3</sup>P) and O (<sup>3</sup>P). The rotation lines of the 0,1 band are split into three components and provide a quant. estimation of the Sn isotope effect. (Cf. A., 1931, 544.) L. G. G.

**Band spectrum of silicon monosulphide.** R. F. BARROW and W. JEVONS (Nature, 1938, 141, 833).—A system of 70 to 80 bands, degraded to the red, has been observed in the region 2576—3876 Å. when heavy-current discharges are passed through a mixture of SiS vapour and A. The rotational structure of the stronger bands appears to be that given by  $a^1\Pi \rightarrow 1\Sigma$  transition. The SiS discharge also shows 70 to 80 bands, extending from 3491 to 6169 Å., which are similar in appearance and distribution to bands in the longer  $\lambda$  sequences of the above system. The emitter may be SiS. The ultra-violet system of SiS

B B\* (A., I.)

is well developed also in a heavy-current discharge through Al<sub>2</sub>S<sub>3</sub> vapour in a SiO<sub>2</sub> tube. L. S. T.

**Rotation analysis of the  $a^3\Pi \rightarrow X^1\Sigma$ ,  $c^3\Sigma^+ \rightarrow a^3\Pi$ , and  $a'^3\Sigma^+ \rightarrow a^3\Pi$  band systems of carbon monoxide.** L. GERÖ (Z. Physik, 1938, 109, 204—209, 210—215, 216—222). L. G. G.

**Predissociation in the CO spectrum at 8.83 volts.** R. SCHMID and L. GERÖ (Physikal. Z., 1938, 39, 460—462).—Predissociation at the end state of the Angström bands of CO for the  $A^1\Pi$  state has been observed, the energy being 8.83 v. This is confirmed by the absorption determinations of Hopfield *et al.* The dissociation scheme of CO has been more closely investigated. A. J. M.

**Absorption spectra of sulphur dioxide and carbon disulphide in the vacuum ultra-violet.** W. C. PRICE and (MISS) D. M. SIMPSON (Proc. Roy. Soc., 1938, A, 165, 272—291).—The spectra have been investigated down to 1000 Å.; the bands can be divided into two classes which exhibit (i) wide vibrational structure, (ii) little or no vibrational structure. Ionisation potentials of the mols. are evaluated and some general features of electronic spectra of polyat. mols. are discussed. G. D. P.

**Calcium subfluoride.** K. H. HELLWEGE (Z. physikal. Chem., 1938, B, 39, 465—470).—The predissociation spectrum of CaF shows that this mol. dissociates to give an excited Ca atom. The following heats of reaction were deduced:  $\text{CaF} + \text{F} = \text{CaF}_2 + 285 \text{ kg.-cal.}$ ;  $2\text{CaF} = \text{CaF}_2 + \text{Ca} + 256 \text{ kg.-cal.}$  Solid CaF is formed by heating CaF<sub>2</sub> with Ca at 1230°. The heat of sublimation of CaF is probably approx. the same as that of Ca. H. J. E.

**Mechanism of the primary photodissociation processes of organic molecules.** E. BERGMANN and R. SAMUEL (Nature, 1938, 141, 832—833).—A theory of photodecomp. of org. mols. is advanced. Two linkings are broken simultaneously, not by the splitting of two single linkings, but by a transition of the mol. from the ground state to a repulsive electronic state which is due to the repulsive character of the S<sup>2</sup> group of electrons of the central atom. Data are given and dissociation processes assumed for Cl<sub>4</sub>, CH<sub>2</sub>O, Ac<sub>2</sub>, EtOAc, and MeCS<sub>2</sub>H. L. S. T.

**Distribution of the rotation states in an elementary molecular formation process (not Boltzmann distribution) and alteration of the relative probability of transition.** H. SCHÜLER and H. GOLLNOW (Z. Physik, 1938, 108, 714—725).—The intensity curves of the  $P$  and  $R$  branches of the CuH band,  $\lambda$  4280, have been determined for excitation ( $a$ ) in the arc and ( $b$ ) in a hollow cathode cooled by liquid air or H<sub>2</sub>O. In ( $a$ ) a Boltzmann distribution among the rotation states was found. In ( $b$ ) a different but simple distribution was found. Results are discussed in relation to transition probabilities. H. C. G.

**Near ultra-violet bands of acetylene.** S. C. WOO, T. K. LIU, T. C. CHU, and W. CHIH (J. Chem. Physics, 1938, 6, 240—246).—The near ultra-violet spectrum of C<sub>2</sub>H<sub>2</sub> has been investigated at room temp. and at 300°; about 1000 lines and bands have been measured. Most bands show intensification at

the higher temp. Seven progressions with reasonable intensity distribution and all with a frequency of approx.  $1050\text{ cm}^{-1}$  have been found; of these, three show no intensification at higher temp. indicating that they arise from transitions from a vibrationless level in the ground state to different vibrational levels in the excited state. All the bands are double-headed with degradation towards the red. Tentative assignments are given.

W. R. A.

**Absorption spectra of praseodymium and neodymium in heavy water.** S. M. KATSCHENKOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, 18, 557—558).—The absorption spectra of  $\text{Pr}_2(\text{SO}_4)_3$  and  $\text{Nd}_2(\text{SO}_4)_3$  in  $\text{D}_2\text{O}$  and in  $\text{H}_2\text{O}$  have been compared in the region of  $5000\text{ \AA}$ . In  $\text{D}_2\text{O}$  the bands are wider and less intense and are shifted towards the violet by  $30\text{--}35\text{ cm}^{-1}$ . The dependence of the spectra on temp. is not the same in the two solutions, and the salts dissolve more slowly, and the solutions are more intensely coloured, in  $\text{D}_2\text{O}$  than in  $\text{H}_2\text{O}$ .

F. J. G.

**Spectroscopic study of the symmetries of the fields about ions in solution.** S. FREED and S. I. WEISSMANN (J. Chem. Physics, 1938, 6, 297).—The absorption spectra of  $\text{EuCl}_3$  and  $\text{Eu}(\text{NO}_3)_3$  indicate, on account of the no. of lines appearing in a particular group near  $4650\text{ \AA}$ , that the field surrounding  $\text{Eu}^{3+}$  in  $\text{EuCl}_3$  is of lower symmetry than that in  $\text{Eu}(\text{NO}_3)_3$ . The symmetry of  $\text{Eu}^{3+}$  is raised when anhyd.  $\text{Eu}(\text{NO}_3)_3$  is dissolved in  $\text{Et}_2\text{O}$  and when it is combined with  $\text{Mg}(\text{NO}_3)_2$ .

W. R. A.

**Continuous absorption spectra of alkyl iodides and alkyl bromides and their quantal interpretation.** D. PORRET and C. F. GOODEVE (Proc. Roy. Soc., 1938, A, 165, 31—42).—The extinction coeff. curve for  $\text{MeI}$  has been analysed and the existence of two bands deduced. Extinction coeffs. of  $\text{EtI}$ ,  $\text{EtBr}$ , and  $\text{BuBr}$  are measured. The influence of the C chain is small, and conditions under which the chromophoric groups retain their individuality are discussed.

G. D. P.

**Spectra of  $R_1\text{--}R_1$  systems. IV. Spectra of *l*-ascorbic, hydroxytetrone, reductic, and  $\alpha$ -crotonic acid.** H. MOHLER and H. LOHR (Helv. Chim. Acta, 1938, 21, 485—496; cf. A., 1937, I, 597).—Absorption spectra of the acids named and of  $\text{CMe}_2\text{CH}\cdot\text{COMe}$ , alone and in presence of  $\text{CuSO}_4$  and/or KCN, are compared. The characteristic absorption is due to the ethylenic linking and is modified by substituents. Both  $\text{CuSO}_4$  and KCN form compounds with ascorbic acid. Oxidation of this acid is due to ionisation to an unstable resonance system; KCN prevents oxidation by combining with this system.

R. S. C.

**Line breadths of the HCN bands.** E. LINDHOLM (Z. Physik, 1938, 109, 223—235).—Measurements of line breadths in the photographic infra-red rotation-vibration bands of HCN are given. The close relation between the line broadening and the quantum state is explained theoretically.

L. G. G.

**New band in the absorption spectrum of the earth's atmosphere.** A. ADEL and C. O. LAMP-LAND (Astrophys. J., 1938, 87, 198—203).—A new band at  $7.6\text{ }\mu$ . is attributed to the presence of  $\text{N}_2\text{O}_5$

in the ozonosphere. One mol. of  $\text{N}_2\text{O}_5$  to 100 of  $\text{O}_3$  is indicated.

L. S. T.

**Molecular association studied in the infra-red.** J. ERRERA and H. SACK (Trans. Faraday Soc., 1938, 34, 728—742).—An infra-red spectrometer is described and its precision discussed. Absorption measurements with 1%  $\text{EtOH}$  in  $\text{COMe}_2$ , dioxan, and in  $\text{C}_6\text{H}_5\text{N}$  reveal a characteristic band at  $3500\text{ cm}^{-1}$  in the first two and at  $3350\text{ cm}^{-1}$  in the last, which is attributed to the formation of  $\text{O}\text{--H}\leftarrow\text{O}$  and  $\text{O}\text{--H}\leftarrow\text{N}$  complexes respectively. These complexes are relatively stable, as is shown by their continued existence on dilution with  $\text{CCl}_4$  and by their insensitiveness to temp. change. The influence of solvents on the chelation band in  $o\text{--OH}\cdot\text{C}_6\text{H}_4\cdot\text{CHO}$  has been studied. In  $\text{CCl}_4$  the band is scarcely affected by changing the concn., whence it is inferred that the tendency to association is nearly eliminated by the chelation. The effect of dioxan, however, is to diminish the chelated character of the  $\text{O}\text{--H}$  and to allow association.

F. L. U.

**Temperature effect in the infra-red spectrum of phenol.** R. R. BRATTAIN (J. Chem. Physics, 1938, 6, 298—299).—The infra-red absorption spectrum of  $\text{PhOH}$  from 1 to  $15\text{ }\mu$ . has been determined at  $25^\circ$ ,  $42^\circ$ , and  $101^\circ$ . The band at  $3.1\text{ }\mu$ . ( $25^\circ$ ) shifts to  $2.96\text{ }\mu$ . when  $\text{PhOH}$  melts ( $42^\circ$ ) and to  $2.92\text{ }\mu$ . at  $101^\circ$ , indicating that the degree of association has remained unaltered between  $42^\circ$  and  $101^\circ$ . The bands at  $7.33\text{ }\mu$ . and  $8.16\text{ }\mu$ . shift progressively to longer  $\lambda\lambda$  on raising the temp. and the intensity and breadth of the  $8.16\text{ }\mu$ . band also increase.

W. R. A.

**Hydrogen bond and infra-red absorption.** A. M. BUSWELL and W. H. RODEBUSH (J. Chem. Physics, 1938, 6, 296—297).—Priority claim over Herman and Hofstadter (A., 1938, I, 174).

W. R. A.

**Infra-red and Raman spectra of polyatomic molecules. II. *cis*- and *trans*- $\Delta^{\beta}$ -butene.** H. GERSHINOWITZ and E. B. WILSON, jun. (J. Chem. Physics, 1938, 6, 247—251).—Using the automatic prism spectrometer (A., 1938, I, 328) the infra-red absorption spectra of gaseous *cis*- (I) and *trans*- $\Delta^{\beta}$ -butene (II) have been determined from  $435$  to  $750\text{ cm}^{-1}$  with a KBr prism and from  $750$  to  $4000\text{ cm}^{-1}$  with a NaCl prism. The Raman spectra of both compounds, as liquids, have also been determined and the polarisation of the lines of (II) has been investigated by the Polaroid method (*ibid.*, 230). (I) is usually attributed to the high-boiling and (II) to the low-boiling isomeride. (II), therefore, has a centre of symmetry and coincidence of Raman and infra-red frequencies is accordingly prohibited by selection rules. The spectroscopic evidence justifies the usual assignments of the isomerides. No conclusion regarding the free rotation of the Me groups is yet possible and doubt is cast on the validity of the assumption that both (I) and (II) have the same vibrational entropies.

W. R. A.

**Combination spectra of the solution of water in dioxan and pyridine.** G. S. LANDSBERG and V. S. MALISCHEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, 18, 549—551).—The broad band  $3460\text{ cm}^{-1}$  of



H<sub>2</sub>O is split into two relatively narrow bands and shifted slightly towards the higher frequencies at high dilution in dioxan. In C<sub>5</sub>H<sub>5</sub>N the band is narrower but the position of the max. is unchanged.

F. J. G.

**Infra-red absorption spectra of gossypol derivatives.** A. M. ZAMISCHLAJEVA and S. S. KRIVITSCH (J. Gen. Chem. Russ., 1938, 8, 319—329).—The absorption spectra of certain gossypol derivatives (dioxime, Ac<sub>6</sub>, dianiline and its Ac<sub>6</sub> compounds) are given for  $\lambda\lambda$  1.5—9  $\mu$ .

R. T.

**Infra-red absorption spectra of isomeric aliphatic hydrocarbons.** P. LAMBERT and J. LECOMTE (Compt. rend., 1938, 206, 1174—1176; cf. A., 1934, 583).— $\nu$  of absorption maxima in the range 500—1450 cm.<sup>-1</sup> are recorded for *n*- and *iso*-C<sub>5</sub>H<sub>12</sub> and for 17 isomeric octanes. A band at 722 cm.<sup>-1</sup> in *n*-C<sub>8</sub>H<sub>18</sub> is displaced to higher  $\nu$ , and decreases in intensity, with increasing complexity of the C chain. The intensity of a band at 1450 cm.<sup>-1</sup> also decreases in the more complex isomerides. The constituents of petroleum fraction are readily identified by their absorption spectra in the range considered.

A. J. E. W.

**Infra-red absorption spectrum of methylene chloride.** C. CORIN and G. B. B. M. SUTHERLAND (Proc. Roy. Soc., 1938, A, 165, 43—53).—26 bands, of which 16 are new, are recorded in the region between 2 and 12  $\mu$ . for the liquid. As one of the intense bands has no counterpart in the Raman spectrum it has been necessary to introduce a new set of fundamental frequencies in terms of which the observed bands are interpreted.

G. D. P.

**Optical investigations on the adsorption of porphyrins.** F. BANDOW (Z. physikal. Chem., 1938, B, 39, 155—193; cf. A., 1937, I, 61).—Data are recorded for the positions of the band max. in the fluorescence spectra of porphyrins in acid, alkaline, and neutral org. solvents, and when adsorbed from such solutions on Al<sub>2</sub>O<sub>3</sub>, CaCO<sub>3</sub>, frankonite, floridin, and kaolin. There was in general a correspondence between the fluorescence spectra in solution and in the adsorbed state, with no systematic displacements to the red in the latter case. The quantum yield in the fluorescence of porphyrin solutions was <1; for adsorbed porphyrins, particularly on moist adsorbents, it was > that in solution. The intensity of fluorescence in solution was used in measuring the adsorption from 5% HCl, 0.4% NaOH, EtOH, and dioxan on to C, Al<sub>2</sub>O<sub>3</sub>, CaCO<sub>3</sub>, Be(OH)<sub>2</sub>, BeO, kieselguhr, kaolin, talcum, floridin, and frankonite. The distribution coeffs. between solid and liquid varied widely. In many cases the porphyrin was readily washed out of the solid phase.

H. J. E.

**Fluorescence of methylacridone and the effect on it of atomic electric fields.** A. SCHÖNTAG and H. FISCHER (Z. physikal. Chem., 1938, B, 39, 411—430).—Data are recorded for the displacement of the fluorescence band of methylacridone (I) in solutions of varying  $p_H$ . The displacement is attributed to distortion of the mol. by H<sup>+</sup> ions. The fluorescence spectrum of (I) in H<sub>2</sub>O or CCl<sub>4</sub> solution at -195° shows a definite structure. The results are discussed

in terms of the potential energy curve of the fluorescent electrons.

H. J. E.

**New example of chemiluminescence.** J. H. HELBERGER (Naturwiss., 1938, 26, 316—317).—When the Mg salt of phthalocyanine was dissolved in boiling tetralin an intense red luminescence was observed. The effect is due to the presence of a small amount of a peroxide in commercial tetralin. Similar results were obtained with the Mg complexes of the porphyrin group, and the Zn complexes of phthalocyanine, tetrabenzoporphyrin, and mesoporphyrin. Cu and Fe complexes, and the free dyes, however, do not show the effect. The phenomenon may be of interest in connexion with assimilation.

A. J. M.

**Luminescence of solid substances.** N. RIEHL (Angew. Chem., 1938, 51, 300—304).—A review.

**Inorganic phosphors without metallic activator.** W. H. BYLER (J. Amer. Chem. Soc., 1938, 60, 1247—1252).—Hydrated ZnSO<sub>4</sub>, MgSO<sub>4</sub>, or SrCl<sub>2</sub> develops fluorescence when heated at temp. which effect partial dehydration; at higher temp. the fluorescence is reduced. BaCl<sub>2</sub> becomes fluorescent when heated above its transition temp.; Al(OH)<sub>3</sub>, Ca(OH)<sub>2</sub>, and Mg(OH)<sub>2</sub> when partly decomposed by heating; 3Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>, Ca(OH)<sub>2</sub>, Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>, and CaHPO<sub>4</sub> when heated at 400°. A Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>-CaHPO<sub>4</sub> mixture gives greater intensity than either constituent alone. It is concluded that, in absence of a sp. metallic activator, the fluorescence is due to formation of complexes of crit. composition through partial decomp., or of crit. physical condition through modification of crystal structure.

E. S. H.

**Growth and decay of phosphorescence in calcium sulphide.** P. J. MULDER (J. Franklin Inst., 1938, 225, 527—547).—The phosphorescence of CaS in different binding materials has been stimulated by light and the total intensity of all  $\lambda\lambda$  emitted measured as a function of time. Similar results are obtained at various temp. if the excitation time is const. For CaS in a given binder a very good empirical relation has been deduced giving the phosphorescence intensity for any temp. within the specified range at any time after the beginning of excitation.

T. H. G.

**Ultra-violet phosphorescence of X-rayed rock-salt crystals.** M. N. DIATSCHENKO (Physikal. Z. Sovietunion, 1938, 13, 55—64).—A sensitive photoelectron counter for radiation of  $\lambda$  <3300 Å. is described. The phosphorescence of a NaCl crystal, excited by X-rays, declines with time according to the law  $N = N_0 e^{-t \times \text{const.}}$ . The phosphorescence reaches saturation after 3 min. exposure. It begins with about 40-kv. X-rays, and attains saturation with 110-kv. rays. It comprises radiations of <1900 Å. and of 1900—2500 Å.

J. W. S.

**Raman effect in boric acid and in some boron compounds.** S. M. MITRA (Indian J. Physics, 1938, 12, 9—14).—Boric acid solution gives Raman lines at 515, 872, and 986 cm.<sup>-1</sup>, whilst the solid acid shows the frequency 882 cm.<sup>-1</sup> and two broad lines at 3195 and 3290 cm.<sup>-1</sup> due to the vibrations of O-H. It is concluded that B(OH)<sub>3</sub> has symmetry *D*<sub>3h</sub>. Results are also included for Me, Et, and Bu borates.

T. H. G.

**Raman effect. LXXXIII. Nitrogen compounds. II. (Azomethane, *as*-dimethylhydrazine, methyl azide, hexamethylenetetramine.)** L. KAHOVEC, K. W. F. KOHLRAUSCH, A. W. REITZ, and J. WAGNER (*Z. physikal. Chem.*, 1938, **B**, **39**, 431—444).—Comprehensive data are recorded and discussed. H. J. E.

**Raman spectrum of some crystalline powders.** E. CANALS and P. PEYROT (*Compt. rend.*, 1938, **206**, 1179—1181).—Raman  $\nu$  have been determined for powdered  $C_{10}H_8$ ,  $H_2C_2O_4$ , tartaric acid (I) and five tartrates, citric acid (II),  $(CH_2)_6N_4$  (III), antipyrine (IV), and pyrimidone (V), and for aq. (I) and (II). The C:O frequency found with OH-acids is strongly intensified in the cryst. state (cf. A., 1935, 146). Duplication of lines occurring with (I) and (II) is attributed to the existence of two forms in the cryst. state. A line at  $1035\text{ cm.}^{-1}$ , attributed to CN, is found with (III) and (IV), but not with (V).

A. J. E. W.

**Raman effect in liquid ethane.** G. GLOCKLER and M. M. RENFREW (*J. Chem. Physics*, 1938, **6**, 295).—The Raman spectrum of liquid  $C_2H_6$  at  $-120^\circ$  is recorded and compared with existing data for the liquid and gaseous states. W. R. A.

**Quantitative investigation of the polarisation of Raman lines from crystals.** H. MICHALKE (*Z. Physik*, 1938, **108**, 748—770).—An apparatus for measuring the intensity and depolarisation of Raman lines from crystals and optically active substances is described. Measurements are recorded for calcite, quartz, and beryl. For calcite results agree with theory, but difficulties arise with vibrations of the  $CO_3$  group; these are discussed. Results for quartz and beryl agree with deductions from infra-red silicate spectra recorded by Schaefer, Matossi, and Wirtz.

H. C. G.

**Simultaneous Raman diffraction by multiple supersonic waves.** L. BERGMANN and E. FUES (*Z. Physik*, 1938, **109**, 1—13).—The diffraction of light by two or more superimposed systems of supersonic waves in liquids and in glass has been examined. The complex diffraction patterns obtained are discussed with the aid of an extension of the Raman-Nath calculation. H. C. G.

**Origin of the new Raman lines due to molecules in the solid state and of the "wing" due to liquids.** S. C. SIRKAR and J. GUPTA (*Indian J. Physics*, 1938, **12**, 35—46).—The Raman spectra of polycryst. masses of PhMe, *cis*- and *trans*- $CHCl:CHCl$ ,  $(CH_2Cl)_2$ , and a mixture of *o*-, *m*-, and *p*-xylene have been measured in the low-frequency region. Intense new lines are observed with the centro-symmetrical mols. but not with others. The new lines are therefore not due to lattice oscillations, nor do they spread out to give the "wing" in the liquid state. The extinction directions of *p*- $C_6H_4Cl_2$  at room temp. and below  $12^\circ$  are the same; hence the orientation of the mols. does not change, as suggested by Vuks. T. H. G.

**Anomalous depolarisation of the light scattered by binary mixtures.** B. K. MOOKERJEE (*Indian J. Physics*, 1938, **12**, 15—24).—Investigations

have been made of (a) the distribution of intensity in the "wing" of the Rayleigh line due to a mixture of  $CS_2$  and MeOH at the crit. solution temp. and (b) the dependence of the depolarisation factor  $p_h$  for a similar mixture of PhOH and  $H_2O$  on the shape of the illuminated vol. Krishnan's theory of "cluster" formation is not supported. T. H. G.

**Scattering of light in liquids.** M. PEYROT (*Ann. Physique*, 1938, [xi], **9**, 335—407).—Measurements are described and results tabulated, with all comparative available data, for the depolarisation factors and the relative intensities of light scattered without change of  $\lambda$  in  $H_2O$  and in 40 org. liquids. From the depolarisation factors, qual. estimations of the optical anisotropy of the mols. are made and discussed. The abs. mol. scattering of  $C_6H_6$  has been measured. Results are discussed in relation to those given by various formulæ. N. M. B.

**Formation of mercury molecules. II.** F. L. ARNOT and M. B. M'EWEN (*Proc. Roy. Soc.*, 1938, **A**, **165**, 133—147; cf. A., 1936, 410).—The balanced space-charge method is used to study the formation of ionised Hg mols. It is concluded that three processes are operative: one involves a collision between two excited atoms, the others a collision between one excited and one normal atom. The appearance potentials for the processes are given. It is suggested that only atoms in *P* states form attachments with normal atoms leading to the formation of mol. ions. G. D. P.

**Electronic affinity of gases.** L. GOLDSTEIN (*Ann. Physique*, 1938, [xi], **9**, 723—803).—The electronic affinity of  $O_2$ ,  $SF_6$ , and  $CF_4$  in the pure state, and when mixed with A, Xe, and Kr, has been examined on the basis of the fact that attraction of electrons by mols. with formation of ions is a problem of electronic collision. The mols.  $O_2$ ,  $SF_6$ , and  $CF_4$  in the pure state behave towards slow electrons as inert gases, there being no tendency for the formation of ions by the capture of electrons. Electro-negative centres produced artificially, e.g., by excitation, and dissociation, or in the case of mixtures with inert gases, by metastable atoms of the admixed gas, can cause capture of electrons. The range of speeds of electrons which can be captured to form ions extends from 0.12 e.v. to that corresponding with the first excitation levels of the mols. concerned. The ionisation potentials of  $O_2$ ,  $SF_6$ , and  $CF_4$  were determined. The vals. for  $O_2$  are 12.6, 16.2, and 21.3 e.v., and for  $SF_6$  and  $CF_4$ , 19.3 and 17.8 v., respectively. A. J. M.

**Characteristics of the system copper-cuprous oxide-copper.** E. WEHNER (*Physikal. Z.*, 1938, **39**, 445—454).—Curves connecting current with voltage, pressure, and contact surface have been obtained for the Cu-Cu<sub>2</sub>O-Cu system, using both d.c. and a.c. The effect of pressure on the current diminishes with increasing pressure, although the effect differs for d.c. and a.c. Two rectifications occur in opposite senses, and variation of voltage and pressure converts one steadily into the other. Rectifying action at the boundary between Cu<sub>2</sub>O and applied electrode rises with increasing resistance, and hence with diminution

of pressure, surface, and potential, in agreement with Nordheim's theory of detector action. A. J. M.

**Oscillographic examination of the unidirectional conductivity of carborundum.** J. K. BOSE and S. R. KHASTGIR (Z. Physik, 1938, 109, 80—84).—50-cycle a.c. at potentials up to about 15 v. was applied to carborundum and the rectification examined oscillographically against a suitable time-base. Multiple contacts at the crystal surface give much less rectification than single point contact, and the rectification diminishes with increase in applied voltage. L. G. G.

**Dielectric after-effect phenomena in solid non-conductors.** G. M. VOGLIS (Z. Physik, 1938, 109, 52—79).—A comprehensive examination of the relationship between the charging or discharging current and time ( $10^{-2}$  to  $10^3$  sec.) for beeswax, mica, glass, and kerafar-U is described. L. G. G.

**Measurements of dielectric loss and of high-frequency conductivity. III. Development and testing of the method of measurement and evaluation.** H. SCHWINDT. **IV. P. WULFF and H. SCHWINDT** (Z. physikal. Chem., 1938, B, 39, 275—289, 290—313).—III. The Rohde method (A., 1936, 1084) is applied to liquids. A condenser is described, suitable for hygroscopic or volatile liquids and also for use at low temp.

**IV.** A small dielectric loss ( $L$ ) was observed in the pure non-polar liquids:  $C_6H_6$ , tetralin, paraffin, and  $C_7H_{16}$ . It was independent of frequency and temp. Presence of  $H_2O$  in  $C_6H_6$  or  $Et_2O$  causes a measurable increase of  $L$ . With addition of an alcohol to a non-polar solvent,  $L$  at first remains almost const., and increases rapidly only beyond a certain concn., which depends on the alcohol used. The conductivity loss for solutions of an alcohol (e.g.,  $Pr^cOH$ ) in a non-polar solvent passes through a max. Data for the temp. and frequency dependence of  $L$  for alcohols are recorded. Solutions of fatty acids (e.g.,  $Bu^cCO_2H$  in isoamyl acetate) show an increase of  $L$  on warming due to dissociation of the double mols. of acid. The effect is more marked in polar than in non-polar solvents. H. J. E.

**Precision method for the determination of the molecular polarisation of non-dissociating liquids.** G. RÖSSELER (Z. Physik, 1938, 109, 150—152).—A reply to criticism (A., 1937, I, 347) and a correction of errors in the original (*ibid.*, 12). L. G. G.

**Possibility of molecular rotation in the solid forms of cetyl alcohol and three long-chain ethyl esters.** W. O. BAKER and C. P. SMYTH (J. Amer. Chem. Soc., 1938, 60, 1229—1236).—Dielectric consts. of Et undecate (I) palmitate (II), and stearate (III), and cetyl alcohol (IV) in the liquid and solid states have been determined over a wide range of temp. and  $\nu$ . Solid (I) shows no general freedom of mol. rotation. (II) undergoes a solid  $\alpha$ - $\beta$  transition at the f.p., and during the process shows greater freedom of mol. rotation than in the liquid; it also shows a hitherto undetected slight transition in the  $\beta$ -form. (III) shows mol. rotation about the long axis in the  $\alpha$ -form. (IV) shows mol. rotation in the

$\alpha$ -form accompanied by strong anomalous dispersion of the dielectric const. Rotation about the long axes of mols. in the  $\alpha$ -form appears to be possible, but in the  $\beta$ -forms, where the mols. are tilted with respect to the planes and more closely packed, no general freedom of rotation is found. E. S. H.

**Dielectric constant of deuterium oxide.** J. WYMAN, jun., and E. N. INGALLS (J. Amer. Chem. Soc., 1938, 60, 1182—1184).—Vals. of  $\epsilon$  and its temp. coeff. for  $D_2O$  and  $H_2O$  at 0—100° are recorded. Throughout the range  $\epsilon$  for  $D_2O$  is slightly  $<$  for  $H_2O$ ; the temp. coeffs. are nearly equal. The results are discussed in relation to heats of solvation and heats of dilution of strong electrolytes. E. S. H.

**Measurements of the dielectric constants of solids by means of ponderomotive forces. III. Rochelle salt.** D. DOBORZYŃSKI (Bull. Acad. Polonaise, 1938, A, 37—61; cf. A., 1938, I, 121, 160).—The dispersion of  $\epsilon$  has been determined at 18.5° for a field of 58 v. per cm.  $\epsilon_b$  and  $\epsilon_c$  ( $\sim 8$ ) are normal;  $\epsilon_a \sim 70$  and 150 for  $\nu$  of  $5 \times 10^6$  and 50 cycles, respectively. Anomalous dispersion (at 60—3000 m.) is due to resonance with piezoelectric  $\nu$ . (Cf. A., 1934, 1291; 1935, 1452; *et al.*) \* I. McA.

**Theory of the propagation of light in an atomically stratified medium.** J. WEIGLE (Helv. Phys. Acta, 1938, 11, 159—180).—A dynamic theory of the propagation of light in crystals is developed. O. D. S.

**Absolute configuration of optically active substances.** W. KUHN (Naturwiss., 1938, 26, 289—296, 305—310).—A review dealing with the determination of the abs. configurations of inorg. complex compounds {e.g.,  $[Co(C_2O_4)_3]K_3$ } and org. compounds (e.g.,  $CHMeEt-OH$  and related compounds), based on the study of the absorption bands of the mols. A. J. M.

**General laws of dynamics and their application.** G. A. LINHART (Riverside Jun. Coll., 1938, 8, 1—24).—Theoretical. By introducing the concept of energy of orientation, certain fundamental laws generally restricted to thermodynamics are shown to be applicable to all unidirectional dynamic processes. Applications discussed are: the penetration of cosmic rays into the earth's atm., magnetism and electromagnetic induction, and the formation of  $H_2O$  and  $D_2O$ . E. S. H.

**Collective electron ferromagnetism.** E. C. STONER (Proc. Roy. Soc., 1938, A, 165, 372—414).—A mathematical investigation of the problem of ferromagnetism. General equations are obtained, using Fermi-Dirac statistics, for the magnetic moment of a no. of electrons in an unfilled energy band of standard form, for which the interchange interaction effects give rise to a term in the energy expression  $\propto$  the square of the magnetisation. Expressions are derived for the variation of magnetisation near the Curie point and at low temp. G. D. P.

**Comparison of wave functions for  $HeH^{++}$  and  $HeH^+$ .** C. A. COULSON and W. E. DUNCANSON (Proc. Roy. Soc., 1938, A, 165, 90—115).—Various approximations are used in a comparative study of the wave functions. For the  $HeH^+$  ion the mol.-orbital approximation is better than the electron-pair.

Ionic and polar terms are included in the final wave function. G. D. P.

**Structural formulæ of unsaturated hydrocarbons.** M. BRUTZCUS (Compt. rend., 1938, 206, 1177—1179).—Modified formulæ for a no. of unsaturated compounds, obviating multiple linkings by the introduction of bivalent C, are proposed and discussed. The modifications are based on thermochemical considerations (cf. A., 1938, I, 253). A. J. E. W.

**Formation of mesomeric systems.** J. KENNER (Nature, 1938, 141, 786—787; cf. A., 1938, I, 178).—The generalisation that mesomeric systems may readily be formed from others closely related to them throws light on many org. and inorg. reactions, several of which are discussed. L. S. T.

**Theory of the liquid state.** H. G. TRIESCHMANN (Z. physikal. Chem., 1938, B, 39, 209—217).—A discussion of the postulates of general theories of the liquid state. H. J. E.

**Theory of liquids.** A. GANGULI (Indian J. Physics, 1938, 12, 25—33).—A general distribution function of mols. is given and special cases for gases, liquids, and solids are considered. The various terms of London's expression for the potential energy are discussed with reference to rotation in liquids and solids, viscosity ( $\eta$ ), polymerisation, formation of glasses, etc. Certain simplified expressions for the distribution function, cohesion, internal forces,  $\eta$ , etc. are reviewed and van der Waals' equation is considered; cohesive forces and  $\eta$  are calc. from it. Some formulæ for  $\eta$  and time of relaxation are obtained in a simplified manner. T. H. G.

**Perturbations of crystal lattices.** (A) Calculation of the heat of autodiffusion of metals and the heat of diffusion of solid solutions. (B) Calculation of the work of penetration of slow electrons into the crystal lattice of a salt. J. CICHOCKI (J. Phys. Radium, 1938, [vii], 9, 129—132; cf. A., 1937, I, 296). O. D. S.

**Modified method for measuring the temperature-dependence of the number of crystallisation nuclei in a supercooled organic liquid.** G. L. MICHNEVITSCH, I. F. BROVKO, and A. V. BABADSHAN (Physikal. Z. Sovietunion, 1938, 13, 103—112).—A modification of Tammann's method is described which is suitable for substances with a large no. of crystallisation centres and high linear rates of crystallisation. A thin flat glass container is used and the temp. during exposure is kept const. to  $\pm 0.5^\circ$ . The curve relating temp. of nucleus formation to no. of centres formed in betol, for const. temp. of development, shows two max., at  $-2.9^\circ$  and  $1.5^\circ$ , respectively. The former is ascribed to anomalous cooling adjacent to the walls of the container. J. W. S.

**Stability of the crystallisation centres of an organic liquid at various temperatures and conclusions therefrom concerning Tammann's method.** G. L. MICHNEVITSCH and I. F. BROVKO (Physikal. Z. Sovietunion, 1938, 13, 113—122; cf. preceding abstract).—The process of "development" of submicroscopic nuclei by heating the supercooled

melt causes instability and only some nuclei can grow to give spherulites and thereby become observable. The no. of these ( $z$ ) varies with the temp. of nucleus formation ( $T_c$ ) and of development ( $T_p$ ) according to  $z = z_0 e^{-\alpha(T_p - T_c)}$ .  $\alpha$  increases rapidly, i.e., stability of centres decreases with diminishing  $T_c$ , so the curve connecting  $z$  with  $T_c$  for const.  $T_p$  is distorted and displaced towards higher temp. The question whether true max. exist in this curve is discussed. J. W. S.

**Example of Brownian molecular motion.** M. VON LAUE (Naturwiss., 1938, 26, 317—318).—Calculation shows that in empty space a conducting sphere possesses thermal rotational motion when it is acted on by a magnetic field. The implications of this result are discussed. A. J. M.

**Eigenvalue problem of a diatomic molecule and calculation of the energy of dissociation.** S. K. CHAKRAVORTI (Z. Physik, 1938, 109, 25—38).—Energies of vibration and dissociation of diat. mols. are calc. wave-mechanically and data given for BeH, CdH, C<sub>2</sub>, and N<sub>2</sub>. The method is superior to those of other authors in that higher order terms are included. Calc. vals. of the energy of dissociation of the above mols. agree more closely with experimental vals. than do those of Morse. L. G. G.

**Quadrupole-quadrupole interatomic forces.** J. K. KNIPP (Physical Rev., 1938, [ii], 53, 734—745).—Mathematical. N. M. B.

**Elimination of the mosaic crystal imperfection effect on width of X-[ray] lines.** J. M. BAČKOVSKÝ (Nature, 1938, 141, 872).—The two kinds of imperfection causing loss of resolving power in the X-ray spectra of crystals are due (i) to mosaic structure and (ii) to an irregular arrangement of the at. planes. The effect of (ii) is inappreciable, and that due (i) to can be made negligible by means of a symmetrical arrangement in which the distances, slit to crystal and crystal to photographic plate, are made equal. L. S. T.

**Influence of chemical binding on X-ray absorption spectra.** R. LANDSHOFF (Rev. Sci. Instr., 1938, 9, 143—147).—A general survey. N. M. B.

**Nature of ionic sign preference in C. T. R. Wilson cloud chamber condensation experiments.** L. B. LOEB, A. F. KIP, and A. W. EINARSON (J. Chem. Physics, 1938, 6, 264—273).—The charge preference in Wilson cloud chamber condensations cannot be accounted for either by introduction of hygroscopic impurities into the embryonic droplet on capturing ions of different sign or by consideration of the electrical double layer at liquid-gas surfaces. Results for C<sub>6</sub>H<sub>6</sub>, PhNO<sub>2</sub>, CHCl<sub>3</sub>, COMe<sub>2</sub>, AcOH (no  $\pm$  effect), H<sub>2</sub>O, EtI, NH<sub>3</sub>Ph PhCl, PhMe, HCl + H<sub>2</sub>O (negative ion first) and EtOH, MeOH, AcOH, BuBr (positive ion first) are discussed. The saturated vapour is assumed to contain embryonic droplets of radius too small for surface forces to come into play and the mols. in these droplets are in a definite but pseudo-cryst. arrangement determined by van der Waals forces. The existence of such pseudo-cryst. droplets or groups in liquids

may account for the cybotactic state ascribed to them from X-ray diffraction studies. W. R. A.

**Structure of metals.** R. A. STEPHEN (Nature, 1938, 141, 748; cf. A., 1938, I, 236).—Scatter of spots in high-dispersion X-ray photographs can also be due to (i) a purely geometrical effect due to the finite convergency of the X-ray beam and (ii) the finite width of the  $K\alpha$  lines. (i) is too small to account for the scattering observed by Müller (A., 1938, I, 67), but (ii) gives results of the correct order. Serious errors in determining lattice consts. and deduced internal stresses will result unless this effect is taken into account. L. S. T.

**Application of X-ray methods to problems of chemical binding.** R. BRILL (Angew. Chem., 1938, 51, 277—282).—A review, with detailed reference to the direct detection of ionic, homopolar, and H bonds and van der Waals forces, from 2-dimensional electron density projections obtained by Fourier synthesis of precision X-ray crystal data for NaCl, diamond, and  $(\text{CH}_2)_6\text{N}_4$  (A., 1938, I, 124). I. McA.

**Crystal structure of montmorillonite.** E. MÄGGDEFRAU and U. HOFMANN (Z. Krist., 1938, 98, 299—323; cf. A., 1935, 1345; 1936, 1450; 1937, I, 17).—In powder X-radiograms made for several montmorillonites of varying composition and humidity, only (00l) and (hkl) reflexions of a rhombic cell with  $a$  5.18,  $b$  8.97 Å.,  $c$  variable, occur. A cross-lattice structure of parallel equidistant pyrophyllitic (A., 1934, 1162) layers (I), separated by layers of  $\text{H}_2\text{O}$  mols., and with 4 Al statistically distributed over the 6 octahedral centres, accords best with measured intensities. It differs from that of Clark *et al.* (A., 1938, I, 52) in assuming (i) continuous hydration, without discrete  $\text{H}_2\text{O}$  positions, (ii) absence of mutual orientation of (I) along  $a$  or  $b$ . The small effect, on intensities, of cationic substitution (6 Mg or 3 Fe + 1 Al for 4 Al) is ascribed to mean at. vibrations  $>$  calc. vals. (A., 1936, 15, 412, 538). I. McA.

**Anomalous mixed crystals. II. Subsidiary components in mixed crystals of the iron ammonium chloride type.** A. NEUHAUS (Z. Krist., 1937, 98, 112—142; cf. A., 1936, 1477; 1938, I, 68).—The hygroscopic isomorphous monoclinic salt hydrates  $\text{MCl}_2 \cdot 2\text{H}_2\text{O}$  (I) ( $\text{M} = \text{Mn, Co, Fe, and Ni}$ ) together with  $\text{FeCl}_3 \cdot \text{H}_2\text{O}$  (II),  $\text{NiCl}_2 \cdot 2\text{H}_2\text{O}$  (stable rhombic form) (III),  $\text{MnCl}_2 \cdot 2\text{NH}_4\text{Cl} \cdot 2\text{H}_2\text{O}$  (IV), and  $\text{FeCl}_3 \cdot 2\text{NH}_4\text{Cl} \cdot \text{H}_2\text{O}$  (V), have been prepared, and crystal properties (goniometric, mechanical, optical, and X-ray) measured and summarised. In combination with  $\text{NH}_4\text{Cl}$ , (II) and (III) deviate from the uniform behaviour of (I). Like their Cu analogue (IV) and (V) show a pseudo-cubic symmetry and intergrowth; the spatial equality of their components favours anomalous miscibility. The extent, mechanisms, and relations of anomalous mixed systems are discussed. I. McA.

**Structure of trisodium tricyanomelamine trihydrate.** J. L. HOARD (J. Amer. Chem. Soc., 1938, 60, 1194—1198).—X-Ray data indicate a hexagonal unit with  $a_0$  10.23 and  $c_0$  5.56 Å., containing  $2\text{Na}_3\text{C}_6\text{N}_9 \cdot 3\text{H}_2\text{O}$ ; space-group  $D_{3h}^3-C\bar{6}2c$ . E. S. H.

**$\alpha$ - $\beta$  Transformation of manganese.** G. JOHANNSEN and H. NITKA (Physikal. Z., 1938, 39, 440—445).—The thermal expansion, electrical conductivity, and X-ray crystal structure of Mn have been determined at high temp. The arrest at 682° previously obtained by thermal methods is due to supercooling of the  $\beta$ -phase. The  $\alpha$ - $\beta$  transition point for 95% Mn is 640—650°, and for 99.95% Mn, 640—710°, both determined by cooling. The val. for 95% Mn determined by heating is 750—800°. A. J. M.

**Nature of chemical linkings. I. Chiolite and similar compounds.** V. CAGLIOTTI and G. GIACOMELLO (Naturwiss., 1938, 26, 317).—The space-group of chiolite has been obtained by the Patterson method of analysis;  $a = 4.96 \times 2$ ,  $c = 5.16$  Å. The formula is  $6\text{NaAlF}_4 \cdot 4\text{NaF}$ . A. J. M.

**Crystal structure of ammonium chlorobromiodide and configuration of the chlorobromiodide group.** R. C. L. MOONEY (Z. Krist., 1938, 98, 324—333; cf. A., 1935, 812).—By X-ray analysis,  $\text{NH}_4\text{ClBr}$  (prep. described) has 4 mols. in the rhombic unit cell with  $a$  6.13,  $b$  8.50,  $c$  9.94 Å.;  $P_{\text{calc}}$ . 3.32; space-group  $V_h^{16}$  ( $Pm\bar{c}n$ ). The complete 8-parameter structure is determined (by Fourier synthesis and otherwise) from visual intensities.  $\text{ClBr}$  is rectilinear with I central; Cl—I is 2.38, and I—Br 2.50 Å.  $\text{NH}_4^+$  is surrounded by 4 Cl and 4 Br in pseudo-cubic alternation at average distances of 3.35, 3.56 Å., respectively.  $\text{NH}_4$ —I is  $<$  3.94 Å. I. McA.

**X-Ray studies of the structure of hair, wool, and related fibres. IV. Molecular structure and elastic properties of the biological cells.** H. J. WOODS (Proc. Roy. Soc., 1938, A, 166, 76—96).—Cells isolated from different types of hair are found to contain cryst. keratin, and they can be built up into tissues giving X-ray photographs comparable with those obtained from the fibres. Cells from retted fibres previously set in steam are found to be stretched but their measured lengths are  $<$  would be expected, indicating that the elastic phase extends inside the cells as well as between them. By the combined action of pressure and steam the cells can be formed into coherent transparent sheets, elastic in  $\text{H}_2\text{O}$  up to 50% extension and extensible in steam or aq. NaOH to 100%. These sheets can be relaxed, set, and supercontracted in the same way as fibres. It is concluded that the behaviour of the fibres is for the most part determined by the properties of the cells. G. D. P.

**Structure of plastically deformed crystals and mechanism of deformation.** A. P. KOMAR (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1937, 789—795; cf. A., 1936, 552, 1449; 1937, I, 117).—The deformation in bent or strained crystals of NaCl, Al, and Mg is interpretable from Laue X-radiograms, using previous methods (*loc. cit.*) and Taylor's slip theory (A., 1934, 950). I. McA.

**Arrangement of molecules in a single layer and in multiple layers.** L. H. GERMER and K. H. STORKS (J. Chem. Physics, 1938, 6, 280—293).—When a highly polished Cr-plated block is dipped through a unimol. film of stearic acid (I) or Ba stearate (II) a single layer of mols. is deposited. Each subsequent

dipping leads to the deposition of two layers. The reflexion of fast electrons from such odd-numbered layers has been investigated. Even-numbered layers are deposited when thin foils of Resoglaz are dipped under similar conditions; two layers are deposited at each dipping, including the first. These layers have been studied by transmission methods. For a single layer of (II) and of (I) on a Cr surface the hydrocarbon chains are closely packed but arranged irregularly and the axes of the chains lie approx. normal to the surface. With odd-numbered layers of mols. it appears that the layer nearest the Cr surface is, like a single layer, close packed but arranged irregularly whilst in the subsequent layers the mols. are arranged regularly in the same manner as on Resoglaz. Even-numbered layers of (II) on Resoglaz give a diffraction pattern which indicates that the mols. are arranged as simple crystals having hexagonal symmetry, that all layers are regularly arranged, and that the chain axes are normal to the surface. In all except the first layer on a Cr-plated surface and in all layers on Resoglaz, (I) mols. are arranged regularly and are built into monoclinic crystals with  $a$  8.27,  $b$  4.96 Å.,  $\beta$  70°; the  $a$  and  $b$  axes are parallel to the supporting surface, the  $b$  axis showing strong preference for the direction normal to the dipping plane. The unique irregular arrangement of the first layer on a Cr surface has been found also for a polished steel surface. On Resoglaz the paraffin end of the mol. is in contact with the foil whereas on the metal support the Ba or CO<sub>2</sub>H groups make contact. It is suggested that the first layer of (I) may react with the metal to form a stearate whilst subsequent layers remain uncombined. The significance of the formation of a metallic stearate (or similar compound) on boundary lubrication may possibly be capable of investigation by electron diffraction methods. Polymorphic forms of (I) crystals are discussed. A single layer of Ba myristate has also been examined and gives results very similar to a single layer of (II). With improved vac. technique it is predicted that layers of adsorbed gases could be investigated by electron diffraction methods.

W. R. A.

**Crystal and molecular structure of CBr<sub>4</sub> and Cl<sub>4</sub>.** H. MARK (Z. physikal. Chem., 1938, B, 39, 314).—The correctness of Finbak and Hassel's data is affirmed (cf. A., 1937, I, 502).

H. J. E.

**Isomorphism of BaCdCl<sub>4</sub>·4H<sub>2</sub>O and BaPt(CN)<sub>4</sub>·4H<sub>2</sub>O.** H. BRASSEUR and A. DE RASSENFOSSÉ (Z. Krist., 1938, 98, 353—355).—In reply to Quodling and Mellor (A., 1938, I, 180) the evidence for and against isomorphism is reviewed. I. McA.

**Crystal growth on calcite surfaces.** G. I. FINCH and E. J. WHITMORE (Trans. Faraday Soc., 1938, 34, 640—645; cf. A., 1937, I, 226).—The orientation of NaNO<sub>3</sub> crystals grown on surfaces of calcite is wholly determined by the substrate crystal surface. Where the latter is of single crystal structure continuous with that of the main crystal, the NaNO<sub>3</sub> crystals are oriented and continue as far as possible the at. arrangement of the underlying calcite, but where the polish layer is shown by electron diffraction to be amorphous, the overgrowths of NaNO<sub>3</sub> are

unoriented. Hence the overgrowth experiments provide independent confirmation of the conclusions based on electron diffraction examination.

F. L. U.

**Measurement of the periodic internal potential of crystals.** A. HAUTOT and J. J. TRILLAT (J. Phys. Radium, 1938, [vii], 9, 133—139; cf. A., 1938, I, 63).—A theory of electron diffraction in metallic crystals, based on the classical theory of metals, is developed. Vals. for the coeffs. of the periodic internal potential of Ni, Au, Cu<sub>2</sub>O, and graphite crystals calc. by this theory from the breadth of electron-diffraction rings produced by the crystals are of the order of magnitude of those derived from a consideration of the electrical properties of the atoms of the crystal. O. D. S.

**Structure of sulphur by means of cathode rays.** J. J. TRILLAT and S. OKETANI (Z. Krist., 1938, 98, 334—343; cf. A., 1934, 1296; 1938, I, 67).—S films prepared by evaporation of CS<sub>2</sub> solutions on H<sub>2</sub>O or Au leaf gradually sublime in vac. By electron diffraction, they are shown to consist of flat rhombic single crystals of variable orientation. Powder diagrams are rarely obtained. Diffraction patterns corresponding with the (111), (011), (010), and (100) planes confirm Warren's X-ray structure (A., 1935, 285). Pattern changes during exposure are due to local reorientation, not to a thermal rhombic → monoclinic transition. I. McA.

**Polymorphous forms of crystalline carbon compounds with long stretched chains, as determined by electron diffraction.** T. SCHOON (Z. physikal. Chem., 1938, B, 39, 385—410).—Stearic acid exists in two forms with  $a$  5.62,  $b$  7.54,  $c$  ≈ 50.0 Å.,  $\beta$  61.2° and  $a$  9.46,  $b$  4.96,  $c$  ≈ 49.15 Å.,  $\beta$  54.2°, respectively. Margaric acid has  $a$  10.45,  $b$  4.63,  $c$  ≈ 48.9 Å.,  $\beta$  55°; cetyl alcohol,  $a$  9.15,  $b$  5.01,  $c$  ≈ 44.8 Å.,  $\beta$  55.5°; palmitic acid,  $a$  9.54,  $b$  4.99,  $c$  ≈ 44.3 Å.,  $\beta$  53.4°; dicetyl ether,  $a$  5.64,  $b$  7.43,  $c$  ≈ 43.4 Å.,  $\beta$  62.9; cetyl palmitate,  $a$  5.60,  $b$  7.49,  $c$  ≈ 93 Å.,  $\beta$  60.8°; C<sub>30</sub>H<sub>62</sub> (first form),  $a$  5.577,  $b$  7.482,  $c$  ≈ 39.8 Å.,  $\beta$  61.9°; (second form)  $a$  4.955,  $b$  7.51,  $c$  39.94,  $\beta$  90°; C<sub>21</sub>H<sub>64</sub>,  $a$  4.97,  $b$  7.49,  $c$  82.22 Å.,  $\beta$  90°; CO<sub>2</sub>H·[CH<sub>2</sub>]<sub>8</sub>·CO<sub>2</sub>H,  $a$  9.6,  $b$  5.0,  $c$  13.8 Å.,  $\beta$  55°; CO<sub>2</sub>H·[CH<sub>2</sub>]<sub>14</sub>·CO<sub>2</sub>H,  $a$  9.5,  $b$  5.0,  $c$  21.3 Å.,  $\beta$  54°. In these substances a small no. of elementary cells are characterised by the vals. of  $a$  and  $b$  and of the monoclinic angle  $\beta$ . The structure of long-chain paraffins and their derivatives, and the transition phenomena of certain paraffins, are accounted for in terms of these simple structural types. H. J. E.

**Molecular structures of the methyl derivatives of phosphorus and arsenic.** H. D. SPRINGALL and L. O. BROCKWAY (J. Amer. Chem. Soc., 1938, 60, 996—1000).—Electron-diffraction investigations show that PMe<sub>3</sub> and AsMe<sub>3</sub> are pyramidal with P and As at the respective apices. PMe<sub>3</sub> has a bond angle 100±4° with P—C 1.87±0.02 Å.; AsMe<sub>3</sub> has a bond angle 96±5° with As—C 1.98±0.02 Å. These distances agree with published vals. for the sums of covalent radii. E. S. H.

**Dynamic theory of space lattice diffraction.** I, II. E. FUES (Z. Physik, 1938, 109, 14—24, 236—259).—I. The theory of space lattice scattering is

derived as a "zero approximation" solution of a three-dimensional Hill differential equation.

II. The calculation of diffraction coupling of  $n$  intense waves in the lattice is dealt with. L. G. G.

Theory of electron diffraction considering more than two rays, and an explanation of the Kikuchi envelope. II. E. LAMLA (Ann. Physik, 1938, [v], 32, 225—241; cf. A., 1938, I, 288).—Diffraction of electron beams at crystal lattice surfaces and the interaction between periodic surface disturbances and the incident electron beam are discussed mathematically. Conclusions are illustrated by reference to the diffraction at the surfaces of spinel and fluor spar. H. C. G.

Theories of electron diffraction. J. FARINEAU (J. Phys. Radium, 1938, [vii], 9, 157—161).—The theories of Kikuchi (A., 1935, 570) and Harding (A., 1937, I, 172) are criticised. A theory is developed in which the crystal is treated as a three-dimensional diffraction grating. Derived vals. for the breadth of electron-diffraction rings are of the order of magnitude of experimental vals. O. D. S.

Influence of general blackening on atomic distances determined by means of electron diffraction. C. FINBAK and O. HASSEL (Z. physikal. Chem., 1938, B, 39, 471—475).—It is shown that the general blackening causes errors in evaluating interat. distances. It is necessary to measure max. in the original negative and min. in the positive, and to use both sets of vals. in evaluating the results. H. J. E.

Electron-optical observations of ion and electron emission from cylindrical emission sources. H. MAHL (Z. Physik, 1938, 108, 771—776).—A method for the simultaneous production of images by ion and electron emission from an internally heated steatite tube is described. Destruction of the screen through ionic irradiation is prevented by electronic focussing of the secondary electrons derived from the ionic emission by bombardment of an auxiliary electrode. L. G. G.

Drift of adsorbed thorium on tungsten filaments heated with direct current. R. P. JOHNSON (Physical Rev., 1938, [ii], 53, 766).—The migration towards the negative terminal of Th adsorbed on W is demonstrated directly in a simple electron-optical tube. N. M. B.

Lattice perturbations, particle size, and heat content of pyrophoric iron. R. FRICKE, O. LOHRMANN and W. WOLF (Z. physikal. Chem., 1938, B, 39, 476; cf. A., 1937, I, 603).—A correction. H. J. E.

Surface phenomena in the cold-working and recrystallisation of metals. G. A. HOMES (Bull. Acad. roy. Belg., 1938, [v], 24, 147—158).—Lattice breakdown by drawing is propagated from the surface towards the interior of the metal under tension. Polishing can produce superficial breakdown, a limiting case being obtained in the amorphous layer detectable by electron diffraction. The growth of new crystals may occur across certain discontinuities, beginning at points where lattice deformation is locally very strong, but such recrystallisation may

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

be masked by the persistence of the contour of the original crystals. J. W. S.

Distinction between the mechanism of static rupture and that of dynamic rupture in crystals. G. A. HOMES and P. DUVEZ (Bull. Acad. roy. Belg., 1938, [v], 24, 159—162).—Whilst static rupture occurs through progressive deformation of all the crystals, fatigue rupture is produced by the progressive deformation of certain parts of the specimen only. The no. of crystals of which the lattices are distorted increases with increased no. of intermittent strains, but generally, at the moment when fracture occurs, there are a large no. of crystals which still remain intact. The repeated stress probably accentuates the unequal initial resistance of the individual crystals. J. W. S.

[Note on] recrystallisation. M. O. KORNFIELD (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1937, 845; cf. A., 1938, I, 179). I. McA.

Magnetic structure of cobalt. W. C. ELMORE (Physical Rev., 1938, [ii], 53, 757—764).—The magnetic powder method was used to investigate Co crystals at room temp. A stable colloid of  $\gamma$ -Fe<sub>2</sub>O<sub>3</sub> was deposited on suitable sections of Co crystals by a magnetic field normal to the surface. Patterns are photographed and discussed in relation to the various energies involved in the demagnetisation of an ideal crystal. Results indicate that the Co patterns do not accord with the structure demanded by simple theory which neglects irreversible energy changes accompanying demagnetisation. A structure explaining the observed patterns is proposed and discussed. N. M. B.

Rotational moment of single cubic crystals in a magnetic field. H. MUSSMANN and H. SCHLECHTWEG (Ann. Physik, 1938, [v], 32, 290—300).—The relation between the rotational moment of single crystals and the direction of the magnetic field is derived theoretically and compared with experiments on a single crystal disc. H. C. G.

Relation between the resistance of nickel crystals and the direction of spontaneous magnetisation. W. DÖRING (Ann. Physik, 1938, [v], 32, 259—276).—The general relationship between the electrical resistance and the direction of magnetisation in cubic ferromagnetic crystals is derived from considerations of symmetry. Results are confirmed by experiments with Ni crystals. H. C. G.

Change of resistance of single crystals of zinc in a magnetic field. B. G. LASAREV and M. M. NOSKOV (Physikal. Z. Sovietunion, 1938, 13, 130—132).—The electrical resistance of single-crystal Zn wires of various orientations has been measured in fields of 0 to 14,100 gauss at temp. of room and of liquid N<sub>2</sub>. J. W. S.

Thermal and electrical resistance of a tungsten single crystal at low temperatures and in magnetic fields. W. J. DE HAAS and J. DE NOBEL (Physica, 1938, 5, 449—463).—Thermal and electrical conductivities have been determined in high magnetic fields at low temp. The Wiedemann-Franz law holds in magnetic fields for the contribution made by electrons to these properties. By using still higher

fields it will probably be possible to separate the heat-conductivity into parts due to the lattice and the electrons. J. H. G.

**Hall effect on single crystals of zinc.** M. M. NOSKOV (Physikal. Z. Sovietunion, 1938, 13, 127—129).—A formula is derived relating the Hall e.m.f. in single crystals to the orientation of the crystal and of the magnetic field; it is shown to be in accord with experiment for single crystals of Zn. J. W. S. T.

**Resonance in crystal beams of sodium-ammonium tartrate.** W. MANDELL (Proc. Roy. Soc., 1938, A, 165, 414—432).—The interaction of two longitudinal oscillations at right angles in a square beam is considered theoretically. If the natural frequencies in the two directions are sufficiently near equality resonance should occur with the production of two new fundamental frequencies. The result is found to agree with experiment. Experiments are also made to determine the change of  $\lambda$  with change of breadth and thickness of the beam. The effect of thickness is small, but change of breadth may alter  $\lambda$  by 20%. G. D. P.

**Reflecting power of ultra-pure aluminium.** P. JACQUET and L. CAPDECOMME (Nature, 1938, 141, 752).—Electrolytically-polished surfaces of pure Al (99.998%) have the same reflecting power, which is uniformly const. over different points of the surface. When exposed to the atm., but protected from dust, no alteration in reflecting power occurs. With mechanically-polished surfaces, reflecting power is less and varies markedly from one surface to another, and from point to point in a given surface. L. S. T.

**Value of Young's modulus for nickel wire as influenced by the diameter.** T. F. WALL (Nature, 1938, 141, 751—752).—Pure annealed wires of diameter  $< \frac{3}{32}$  in. approx. show a rapid fall of the val. of Young's modulus with a decrease in diameter. A similar curve is obtained with Cu-plated Ni wires heated in  $H_2$  to a condition of max. magnetic permeability. L. S. T.

**Cause of premature rupture of crystals.** A. V. STEPANOV (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1937, 797—813; cf. A., 1937, I, 504; 1938, I, 182, 183).—Further experiments on rock-salt, including the effect of grooves, and examination with polarised light of crystals stretched along [110] and [111] directions, confirm the primary cause as plastic deformation. The interaction of slip and local distortion is discussed. A range of tensile strengths 80—2000 g. per sq. mm. (normal val.  $\sim 500$ ) is attainable under varied conditions. I. McA.

**Alteration of the atomic lattice by plastic deformation in crystals.** S. T. KONOBEVSKI (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1937, 845).—A summary. I. McA.

**Mechanics of plastic deformation of crystals.** M. V. JAKUTOVITSCH (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1937, 843—844). I. McA.

**Theory of plastic deformation and twinning.** J. FRENKEL and T. KONTOROVA (Physikal. Z. Sovietunion, 1938, 13, 1—10).—Theoretical. The process

suggested comprises a caterpillar-like motion of one at. chain over another. J. W. S.

**Twin formation [in crystals] as a lattice-geometry theory of numbers problem, with application to some real cases.** III. I. SCHAAKKE (Z. Krist., 1938, 98, 281—298; cf. A., 1938, I, 234).—The principles developed previously are applied to the penetration twinning of fluorspar and pyrite. I. McA.

**Electrical properties of vanadium pentoxide.** I. K. KRCH (Abh. Staatsuniv. Saratov, 1938, 14, 54—71).—The prep. of single crystals of pure  $V_2O_5$  is described. Vals. for the conductivity  $\sigma$  along the *c* axis between  $-125^\circ$  and  $175.5^\circ$  are recorded. The expression  $\sigma = \sigma_0 e^{-E/2RT}$  is confirmed, but *E* is 0.408 e.v. below  $25^\circ$  and 0.268 above  $40^\circ$ . Impurities lower  $\sigma$  and increase *E*. The Hall effect is positive between  $-32^\circ$  and  $31^\circ$  and negative (*i.e.*, normal) between  $31^\circ$  and  $101^\circ$ . The e.m.f. of the thermocouple  $Ag|V_2O_5$  has a max. at  $25-35^\circ$  (approx.  $8 \times 10^{-4}$  v. per degree). On cooling from  $25^\circ$  it decreases rapidly, and on warming above  $35^\circ$ , slowly; the cold joint is negative. An explanation of the results is based on the assumption that at low temp. the "holes" are more, and at higher temp. less, mobile than electrons. J. J. B.

**Resistance of superconducting cylinders in a transverse magnetic field.** A. D. MISENER (Proc. Roy. Soc., 1938, A, 166, 43—55).—Measurements of the field strength required to restore the first traces of electrical resistance at temp. below the normal transition point were made on specimens of Sn, In, and Pb. The ratio to the crit. field is a linear function of the temp. The results are consistent with the view that after penetration of the external field the cylinder breaks up into regions of normal and superconducting material. The existence of these regions is demonstrated experimentally. G. D. P.

**Thermo-electromotive forces of a superconductor against the same metal in the non-superconductive state.** W. H. KEESOM and C. J. MATTHIJS (Physica, 1938, 5, 437—448).—An e.m.f. should exist in a circuit consisting of a wire two parts of which are in different magnetic fields, if the places where there are field gradients are also at different temp. Such e.m.f. have been detected for Sn and In, the results in the latter case agreeing with those found previously. For Sn no comparison could be made. The observations agree broadly with the formula of Kok (cf. A., 1937, I, 292). T. H. G.

**Magnetic threshold values for superconductivity.** M. VON LAUE (Ann. Physik, 1938, [v], 32, 253—258).—Magnetic threshold vals. are calc. for a cylindrical conductor in a transverse field and for a conical conductor in a homogeneous field. H. C. G.

**Paramagnetism of tritolylammonium perchlorate and Wurster-red.** P. RUMPF and F. TROMBE (J. Chim. phys., 1938, 35, 110—113; cf. A., 1938, I, 238).—Wurster-red in MeOH is paramagnetic, supporting the structure proposed by Weitz (A., 1929, 190). The analogy with  $[(C_6H_4Me)_3N]^+ClO_4^-$  is discussed. E. S. H.



**Theory of susceptibility of paramagnetic alums in alternating fields.** M. FIERZ (*Physica*, 1938, 5, 433—436).—The partial suppression of the paramagnetism of alums of the Fe group by high-frequency alternating fields is discussed. A formula is deduced which, although it gives results which are too low, correctly shows that the residual magnetisation is independent of the field but varies with temp.

T. H. G.

**Purification and magnetic properties of mercury.** L. F. BATES and C. J. W. BAKER (*Proc. Physical Soc.*, 1938, 50, 409—412).—Differences in the magnetic properties of several specimens of Hg purified by Hulett's method were removed by subsequent heating in vac. at 260° for some time. The temp. variation of the mass susceptibility of Hg so treated was measured and results are discussed with reference to Stoner's theory (cf. *A.*, 1936, 266).

N. M. B.

**Magnetic susceptibility of the iron in ferro-haemoglobin.** D. S. TAYLOR and C. D. CORYELL (*J. Amer. Chem. Soc.*, 1938, 60, 1177—1181).—The paramagnetic susceptibilities per formula-wt. of Fe in haemoglobins of the cow, horse, sheep, and man are 12,290, 12,260, 12,390, and 11,910  $\times 10^{-6}$  c.g.s.u., respectively, at 25°. For cow haemoglobin this quantity is const. for different individuals and unaffected by haemolysis. The calc. magnetic moment for cow haemoglobin is  $5.435 \pm 0.015$  Bohr magnetons; for horse, sheep, and human haemoglobin the moments are 5.43, 5.46, and 5.35, respectively. The presence in normal blood and in oxyhaemoglobin solutions of haemoglobin-like compounds which do not combine with O<sub>2</sub> is noted. Fe is present as Fe<sup>III</sup> in these compounds; its at. paramagnetic susceptibility has been approx. determined. The haemoglobin concn. determined from the CO capacity after reduction agrees with that determined from the Fe content. Haemoglobin concns. can be determined magnetometrically with high precision.

E. S. H.

**Diamagnetic susceptibility of bismuth.** M. BLACKMAN (*Proc. Roy. Soc.*, 1938, A, 166, 1—15).—An extension of the theoretical treatment, consisting of a more general assumption as to the form of the surface of const. energy of the electrons, leads to a satisfactory account of the observed variations of susceptibility of Bi with field strength at low temp.

G. D. P.

**Determination of elastic constants by means of ultrasonic waves.** A. WALTI (*Helv. Phys. Acta*, 1938, 11, 113—139).—Positions of max. and min. transp. of thin glass wedges to ultrasonic waves from  $1 \times 10^6$  to  $12.48 \times 10^6$  Hz. have been determined. Derived vals. for the elastic const. of glass agree with static vals. The conclusions of Bez-Bardilli (cf. *A.*, 1935, 289) are criticised.

O. D. S.

**Precision method for the determination of supersonic wave velocity in liquids.** N. SEIFEN (*Z. Physik*, 1938, 108, 681—697).—The accuracy of the visual method, developed by Hiedemann and his co-workers for measuring the velocity of sound in liquids, has been improved by referring all frequency measurements to the natural frequencies of

an accurately calibrated quartz rod. Measurements are recorded for H<sub>2</sub>O, PhMe, NH<sub>2</sub>Ph, xylene, PhNO<sub>2</sub>, and CCl<sub>4</sub>, and the temp. coeffs. calc. over the range 23—27°.

H. C. G.

**Absorption of ultrasonic waves by organic liquids.** S. PARTHASARATHY (*Current Sci.*, 1938, 6, 501—502).—Data for 21 org. liquids, including hydrocarbons, aliphatic alcohols and acetates, PhCl, CHCl<sub>3</sub>, CCl<sub>4</sub>, COMe<sub>2</sub>, and CS<sub>2</sub>, are recorded for the frequency range 3 to 16 M-cycles. The coeffs. for C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>, CCl<sub>4</sub>, and CS<sub>2</sub> are markedly high, and the vals. of  $\gamma$  obtained from the data for these liquids are also high.

L. S. T.

**Sound absorption and dispersion in liquids.** H. O. KNESER (*Ann. Physik*, 1938, [v], 32, 277—289).—A relation between frequency, sound velocity, and absorption in liquids is derived. It is similar to that for gases, and compares favourably with the experimental results for 12 liquids. Temp. variations and the mixing of liquids are considered. The apparent observed absence of sound dispersion is explained.

H. C. G.

**Reflexion from crystals in the far ultra-violet.** G. RATHENAU (*Physica*, 1938, 5, 417—426).—Light of  $\lambda$  2350—1550 Å. has been reflected from crystal surfaces at 45° and the following variations in reflecting power have been observed: NaNO<sub>3</sub>, pronounced decrease for short  $\lambda$ ; calcite, increase as  $\lambda$  decreases; K<sub>4</sub>Fe(CN)<sub>6</sub>, min. at  $\sim 2000$  Å.; diamond, gypsum, and S, no marked variation.

T. H. G.

**Ultra-violet dispersion in water (6—35°).** M. BAYEN (*Compt. rend.*, 1938, 206, 1254—1256).—An improved apparatus (cf. *A.*, 1936, 409) has been used to measure the dispersion of distilled H<sub>2</sub>O between 2500 and 5893 Å. The results are compared with those of other observers and expressions for  $n = \text{function } (t)$  and  $n = \text{function } (\lambda)$  are given.

J. A. D.

**Refractive index and dispersion of distilled water for visible radiation, at temperatures 0° to 60°.** L. W. TILTON and J. K. TAYLOR (*J. Res. Nat. Bur. Stand.*, 1938, 20, 419—477).—The refractive index,  $n$ , of H<sub>2</sub>O has been determined by the min. deviation method to within  $\pm 1$  or  $2 \times 10^{-6}$  from 0° to 60° and for  $\lambda$  7000—4000. The data were adjusted by least squares and are represented by a general formula having 13 const. A table of  $n$  against temp. and  $\lambda$  gives data to 6 decimal places by linear interpolation. The max. val. of  $n$  is near 0° and varies by  $\sim 0.5^\circ$  for different  $\lambda$ .

D. F. R.

**Nature of heat vibrations at very low temperatures.** F. MICHAUD (*J. Chim. phys.*, 1938, 35, 99—109).—Theoretical. Entropy pressure is defined by  $P_1 = dw/dv$ , where  $w$  is the work involved in varying the vol.  $v$  of a system containing a const. quantity of entropy. Vals. of  $P_1$  at 50—298.1° K. have been calc. from published data for Ag, Al, C, Ca, Cd, Cu, Pb, and Tl; the vals.  $\alpha$  (abs. temp.)<sup>4</sup>. The velocity of heat vibrations at very low temp. is equal to that of transverse mechanical vibrations.

E. S. H.

**Thermodynamic temperature scale below 1° K.** W. JACYNA, L. MALIS, and A. OBNORSKY (*Bull.*

Acad. Polonaise, 1938, A, 33—36; cf. A., 1938, I, 72).—Comparative notes on the thermomagnetic and thermodynamic scales, with crit. remarks on previous treatments (A., 1934, 1061; 1935, 1217; 1936, 930; 1937, I, 231). I. McA.

**Low-temperature studies. III. Low-temperature calorimeter. Heat capacity and entropy of thallium from 14° to 300° K.** J. F. G. HICKS, jun. (J. Amer. Chem. Soc., 1938, 60, 1000—1004; cf. A., 1937, I, 634).—Apparatus and procedure are described. Heat capacity data for Tl are recorded; the calc. entropy at 298.2° K. is  $15.35 \pm 0.05$  e.u.

E. S. H.

**Transformations of solid CD<sub>4</sub> and of its mixtures with CH<sub>4</sub>.** E. BARTHOLOMÉ, G. DRIKOS, and A. EUCKEN (Z. physikal. Chem., 1938, B, 39, 371—384).—The mol. heat of condensed CD<sub>4</sub> was measured from 20° to 30° K.; peaks in the  $C_p$ - $T$  curve occur at 21.9° and 26.95° K. The heats of transformation are  $25 \pm 2$  g.-cal. and  $51 \pm 3$  g.-cal., respectively. The corresponding val. for CH<sub>4</sub>, which has only one transition point, is 15.7 g.-cal. The heat of fusion of CD<sub>4</sub> is  $213 \pm 3$  g.-cal. per mol. Data for CH<sub>4</sub>-CD<sub>4</sub> mixtures are recorded. In mixtures the 26.95° peak for CD<sub>4</sub> is shifted linearly by CH<sub>4</sub> additions until the val. for pure CH<sub>4</sub> (20.6° K.) is attained. The val. of the lower transition temp. is also depressed by CH<sub>4</sub> additions but the peak in the curves disappears with >85% of CH<sub>4</sub>. H. J. E.

**Recalescence in uranium.** W. L. HOLE, R. WRIGHT, and H. B. WAHLIN (Physical Rev., 1938, [ii], 53, 768).—A double recalescence, resembling that in Fe at the  $\beta$ - $\gamma$  transition, has been observed. It indicates changes in the crystal structure of U at about 600° and 800°.

N. M. B.

**Ounce mol. wt. of a gas.** H. D. H. DRANE (Nature, 1938, 141, 791—792).—Attention is directed to the fact that an oz. mol. wt. of a gas occupies 22.4 cu. ft. at 0° and 760 mm.

L. S. T.

**Acceptability of theoretical and applied thermodynamics in the light of the modern atomic theory.** J. J. VAN LAAR (Chem. Weekblad, 1938, 35, 351—363).—Classical thermodynamical expressions are critically reviewed.

D. R. D.

**Theory of condensation.** B. KAHN and G. E. UHLENBECK (Physica, 1938, 5, 399—416).—Mayer's theory of condensation is discussed and shown not to be confined to classical statistical mechanics. Assumption of the additivity property of intermol. forces is not essential. The analogy between Mayer's theory for the condensation of a non-ideal gas and Einstein's theory for an ideal Bose gas is revealed. Assuming certain properties of a function representing the behaviour of a real gas, a rigorous derivation of the condensation phenomenon is deduced.

T. H. G.

**Critical phenomena in gases. II. Vapour pressures and boiling points.** J. E. LENNARD-JONES and A. F. DEVONSHIRE (Proc. Roy. Soc., 1938, A, 165, 1—11; cf. A., 1938, I, 130).—A direct calculation is made of b.p. in terms of interat. forces. The results for Ne, Ar, and N<sub>2</sub> are in agreement with

observation. A theoretical foundation for Trouton's rule is established.

G. D. P.

**Theory of measurement of viscosity and slip of fluids by the oscillating-disc method.** G. E. MACWOOD (Physica, 1938, 5, 374—384).—The theory is extended to fluids of all densities and viscosities which exhibit slip. Two special cases, which together cover all possibilities, are considered. The end correction is discussed and found to be negligible for liquid He and gases at low temp. The fluid motion must not be turbulent.

T. H. G.

**Elastic constituent of rubber.** T. C. ROBERTS (Nature, 1938, 141, 834).—X-Ray examination of specimens of freshly prepared, unstretched caoutchouc (I) (A., 1938, II, 150) at 35° shows certain sharply-defined rings identical with those reported (A., 1937, I, 351) for "frozen" rubber. Other rings show significant differences. At 700% extension (I) gives an X-ray diagram almost identical with that obtained from stretched, air-dried, fresh latex, with the transition from the Debye-Scherrer rings to the sharply-defined spots of the fibre pattern clearly visible. The purified rubber hydrocarbon, caoutchene, does not give the rings characteristic of (I), not can it be extended sufficiently to give the fibre characteristic of stretched rubber. (I) is thus the primary factor in the elasticity of rubber.

L. S. T.

**Theory of initial plastic deformation.** V. A. SHDANOV (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1937, 815—821; cf. Taylor, A., 1934, 950).—Mathematical. Initial plastic deformation of a solid is assumed to be due to a local transition from periodic to aperiodic particle motion (through external and thermal forces) with an activation energy  $E$  depending on the m.p.  $E$  is low where van der Waals energy is high, explaining high plasticity in AgCl, TiCl, and not in alkali halides. A formula analogous to Orowan's (A., 1934, 949) relating shearing stress,  $E$ , and temp. agrees with experiment for Cd and Zn.  $E$  is discussed in relation to melting; in amorphous substances it is a continuous function of temp., hence softening should occur.

I. McA.

**Present state of the problem of hardness.** V. D. KUZNETZOV (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1937, 751—784).—A review of the conception and the varied physical properties involved in its measurement by current methods, with suggestions for research.

I. McA.

**Determination of self-diffusion in solid hydrogen from the course of the ortho-para-hydrogen transformation.** E. CREMER (Z. physikal. Chem., 1938, B, 39, 445—464).—A theoretical treatment is given for the rate of conversion of ortho- into para-H in the solid phase for the cases when the mols. do and do not diffuse. From a comparison with experiment the coeffs. of self-diffusion at 11.3—13.6° K. are calc. The activation energy for the interchange of positions of 2 mols. in solid H is  $791 \pm 130$  g.-cal. Corr. vals. for the velocity coeff. of the ortho-para-H conversion in the solid phase are given.

H. J. E.

**Diffusion in a centrifugal field of force.** W. J. ARCHIBALD (Physical Rev., 1938, [ii], 53, 746—752).—Mathematical. The general equation for the settling

of particles and mols. in a liquid suspension or ideal solution in a centrifuge has been solved for the case of a sector-shaped cell extending to the centre of the centrifuge. Curves are given which show the concn. at all points in the cell for different vals. of the time.

N. M. B.

**Thermal conduction in hydrogen-deuterium mixtures.** C. T. ARCHER (Proc. Roy. Soc., 1938, A, 165, 474—485).—The hot-wire method is used to measure the thermal conductivity of  $H_2$ , and  $D_2$ , and mixtures of the two gases. The apparatus and method of prep. of the gases are described. The accommodation coeffs. of H and D relative to Pt at 0° are evaluated.

G. D. P.

**Density of aqueous solutions of hydrochloric acid.** G. ÅKERLÖF and J. TEARE (J. Amer. Chem. Soc., 1938, 60, 1226—1228).—Equations for calculating  $d$  at arbitrary concns. and temp. have been derived and used to compute a table for solutions containing 0—38 wt.-% of HCl at 0—80°.

**Dipole interaction in mixtures of water with methyl, ethyl, and  $n$ -propyl alcohols, and of ethyl alcohol with  $n$ -heptane.** A. R. MARTIN and A. C. BROWN (Trans. Faraday Soc., 1938, 34, 742—748; cf. A., 1937, I, 127).—A linear relation between  $-\log a/N$  ( $a$  = activity,  $N$  = mol. fraction of  $H_2O$ ) and  $(\epsilon - 1)/(2\epsilon + 1)$  is shown by mixtures of  $H_2O$  with MeOH, EtOH, and Pr<sup>o</sup>OH except at vals. of  $N$  ( $>0.9$  for EtOH,  $>0.6$  for Pr<sup>o</sup>OH) at which the influence of the pseudo-cryst. structure of  $H_2O$  is apparent. The relation holds over the whole range for EtOH in  $n$ -C<sub>7</sub>H<sub>16</sub>. It is inferred that in these mixtures the deviations from Raoult's law of the partial v.p. of  $H_2O$  (or polar component) are accounted for by dipole interaction.

F. L. U.

**System cobalt-zinc.** J. SCHRAMM (Z. Metallk., 1938, 30, 10—14).—The system has been examined up to 55% Co by thermal and X-ray analysis; the following intermediate phases exist:  $\beta$  (apparently body-centred cubic), stable only at high temp. and converted into  $\beta_1$  (cubic  $\beta$ -Mn lattice with 20 atoms in unit cell) below 924°;  $\Gamma$  (with a  $\gamma$ -brass structure and 52 atoms in unit cell), and  $\delta$ ,  $\delta_1$ , and  $\zeta$  (formed by various types of distortion from  $\Gamma$ ). The homogeneity range at 20° of  $\beta_1$  is 41—49.5% Co, of  $\Gamma$  13.5—23% Co, of  $\delta_1$  10.5—11.5% Co, and of  $\zeta$  6.6—8.2% Co. Peritectic horizontals occur at 966° ( $\gamma$  + liquid  $\rightleftharpoons$   $\beta$ , 34—49% Co), at 895° ( $\beta_1$  + liquid  $\rightleftharpoons$   $\Gamma$ , 31—46% Co), at 746° ( $\Gamma$  + liquid  $\rightleftharpoons$   $\delta$ , 6—14% Co), and at 566° ( $\delta_1$  + liquid  $\rightleftharpoons$   $\zeta$ , 2—9.5% Co), peritectoid horizontals at 925° ( $\gamma$  +  $\beta$   $\rightleftharpoons$   $\beta_1$ ) and at 690° ( $\Gamma$  +  $\delta$   $\rightleftharpoons$   $\delta_1$ ) and the eutectic horizontal at 419° (0.02—6.6% Co); in addition there are horizontals at 924° and 675° along which the reactions  $\beta$   $\rightleftharpoons$   $\beta_1$  + liquid and  $\delta = \delta_1$  + liquid take place respectively. Zn dissolves only 0.02% Co and the eutectic contains 0.09% Co.

A. R. P.

**X-Ray study of the superlattice in certain alloys.** E. A. OWEN and I. G. EDMONDS (Proc. Physical Soc., 1938, 50, 389—397).—An investigation of superstructures in the  $\beta$ -phases of Ag-Zn and Au-Zn alloys under various heat-treatments shows that in Au-Zn the atoms are in ordered arrangement in

quenched specimens and in specimens maintained at temp. up to the m.p., but in Ag-Zn they are so arranged only in quenched specimens. Results are discussed with reference to the Bragg-Williams order-disorder theory.

N. M. B.

**Heat of formation of non-ferrous metal alloys.** O. KUBASCHEWSKI and W. SEITH (Z. Metallk., 1938, 30, 7—9).—The heats of formation of the various intermetallic compounds of Na with Pb, Bi, Sn, Sb, Hg, and Cd, of Li with Pb, Bi, Sn, and Sb, and of Mg with Pb and Bi have been determined. The heat of formation-composition curves show max. at NaSn, Li<sub>2</sub>Sn<sub>2</sub>, Na<sub>2</sub>Sb, Li<sub>3</sub>Sb<sub>2</sub>, and NaHg<sub>2</sub>, and points of inflexion at Na<sub>3</sub>Sn, Li<sub>4</sub>Sn, LiSn, and Na<sub>3</sub>Hg<sub>2</sub>; the other compounds in these systems are not shown on these curves.

A. R. P.

**Widmannstätten structure of aluminium-silver alloys.** G. I. PETRENKO and F. A. DERKATSCHEV (Ukrain. Chem. J., 1938, 13, 69—79).—Widmannstätten structure can be produced in alloys with 40—80% Al by heating at 380—400° for a time which is inversely  $\propto$  degree of saturation of the solid solutions. When these are highly unsaturated (40—45% Al) the alloys have to be heated for a short time at the sintering point, and then at 400°, in order to develop the structure.

R. T.

**Stereomagnetism. IV. Magnetic linking.** O. VON AUWERS (Wiss. Veröff. Siemens-Werken, 1938, 17, Part 2, 74—93; cf. A., 1937, I, 606).—A relation between Curie temp. and magnetic moment for binary alloys is derived from published data. The magnetic properties of the Heusler alloys are discussed, with special reference to the influence of heat-treatment.

E. S. H.

**X-Ray and microscopic investigations on the equilibrium diagram of the aluminium-magnesium-cadmium system.** K. RIEDERER (Z. Metallk., 1938, 30, 15—16).—Alloys of a composition approximating to Mg<sub>2</sub>Cd in which part of the Mg is replaced by Al have a hexagonal structure  $a$  3.12 Å.,  $c/a$  1.63, in which some of the atoms are displaced from their true position; the lattice closely resembles that of the binary compound MgCd<sub>2</sub> but is stable only in the presence of Al. A ternary equilibrium diagram of the system at 230° is given showing the two- and three-phase regions and the range of immiscibility.

A. R. P.

**Alloys of iron, copper, and molybdenum.** W. DANNÖHL (Wiss. Veröff. Siemens-Werken, 1938, 17, Part 2, 1—13).—The ternary equilibrium diagram has been determined by means of thermal analysis and microscopical examination.

E. S. H.

**Composition of minima in binary systems of the solid solution type.** M. HARA (Nature, 1938, 141, 873—874).—For the completely isomorphous binary systems investigated, the composition of the metals at the min. on the f.-p. curve corresponds with a simple at. ratio, e.g., Au<sub>3</sub>Cu<sub>2</sub>, Au<sub>3</sub>Ni<sub>2</sub>, RbCs, Rb<sub>2</sub>K, PdFe (?), PdCo, PtCo<sub>3</sub> (?), FeNi<sub>2</sub>, Fe<sub>3</sub>Cr, Fe<sub>2</sub>V, and Sb<sub>4</sub>As.

L. S. T.

**Solubility and factors influencing it.** H. G. TRIESCHMANN (Z. physikal. Chem., 1938, B, 39, 218—245).—Data are recorded for the solubility of acet-

anilide at 17° in MeOH, EtOH, Pr<sup>o</sup>OH, Pr<sup>β</sup>OH, Bu<sup>o</sup>OH, Bu<sup>β</sup>OH, Bu<sup>γ</sup>OH, *n*-C<sub>6</sub>H<sub>13</sub>·OH, PhCl, COMe<sub>2</sub>, Et<sub>2</sub>O, C<sub>6</sub>H<sub>14</sub>, CCl<sub>4</sub>, C<sub>6</sub>H<sub>6</sub>, dioxan, and H<sub>2</sub>O, and in binary mixtures of the alcohols with C<sub>6</sub>H<sub>6</sub>, C<sub>6</sub>H<sub>14</sub>, CCl<sub>4</sub>, and dioxan. The solubility in each case passes through a max. as the composition of the binary solvent mixtures is varied. Further data are given for the solubility in mixed alcohols, and in mixtures of PhCl, Et<sub>2</sub>O, or COMe<sub>2</sub> with C<sub>6</sub>H<sub>6</sub>, CCl<sub>4</sub>, or C<sub>6</sub>H<sub>14</sub>. Comparative data for quinol are given. The contributions of dipole moments and of residual valencies in determining the observed solubilities are discussed. H. J. E.

**Reciprocal solubility in water of boric acid with KH<sub>2</sub>PO<sub>4</sub>, NaH<sub>2</sub>PO<sub>4</sub>, KH<sub>2</sub>AsO<sub>4</sub>, and NaH<sub>2</sub>AsO<sub>4</sub>. Borophosphates and boroarsenates. IV.** G. R. LEVI and A. AGUZZI (Gazzetta, 1938, 68, 179—184).—The ions H<sub>2</sub>PO<sub>4</sub>' and H<sub>2</sub>AsO<sub>4</sub>' greatly increase the solubility of H<sub>3</sub>BO<sub>3</sub> due to the formation of complex borophosphates and boroarsenates. Solubility data for KH<sub>2</sub>PO<sub>4</sub> and NaH<sub>2</sub>AsO<sub>4</sub> at 0°, 25°, and 50° are recorded.

O. J. W.

**Distribution of diethyl tartrate between ether and aqueous borate solution. Equilibrium of boro-diol complex formation.** Y. TSUZUKI (Bull. Chem. Soc. Japan, 1938, 13, 337—349).—The partition coeff. of [·CH(OH)·CO<sub>2</sub>Et]<sub>2</sub> between Et<sub>2</sub>O and H<sub>2</sub>O is *c*<sub>2</sub>/*c*<sub>1</sub> = 2.22 at 20° and is independent of concn. Solutions of Na<sub>2</sub>B<sub>4</sub>O<sub>7</sub> or KBO<sub>2</sub> give much higher coeffs. which increase with dilution. Study of the equilibrium of the complex formed in the aq. phase indicates the co-existence of compounds of the mono-diol and di-diol types. The complex formation is exothermic and the heat of formation is calc. The distribution is little affected by boric acid. F. L. U.

**Adsorption of vapours at plane surfaces of mica. I.** D. H. BANGHAM and S. MOSALLAM (Proc. Roy. Soc., 1938, A, 165, 552—568).—The adsorption isotherms of C<sub>6</sub>H<sub>6</sub>, CCl<sub>4</sub>, and MeOH on mica (muscovite) have been studied. At low pressures the isotherms of C<sub>6</sub>H<sub>6</sub> and MeOH agree with the theoretical equation for films of mobile mols. oriented end-on to the surface. The isotherms of CCl<sub>4</sub> show a series of discontinuities indicating a strong tendency for the mols. to cluster together under the influence of intermol. attractive forces. G. D. P.

**Oscillography of adsorption phenomena. III. Rates of deposition of oxygen on tungsten.** M. C. JOHNSON and A. F. HENSON (Proc. Roy. Soc., 1938, A, 165, 148—160; cf. A., 1937, I, 436).—An experimental arrangement is described whereby the O<sub>2</sub> pressure at the surface of a W filament is made to rise from zero to a const. val. The rate of primary adsorption and its dependence on pressure and temp. are measured before the monolayer becomes sufficiently dense to allow oxidation and thinning of the filament. The adsorption is traced by photographic registration of the fall of electron emission by means of an oscillograph. A condensation const. is obtained and its temp. coeff. implies a heat of activation = 24,000 ± 3000 g.-cal. per mol. at about 2200° K. The bearing of the observations on theories of activated adsorption is discussed. G. D. P.

**Chemisorption on charcoal. X. Hydrolytic adsorption.** H. H. CHAMBERS and A. KING (J.C.S., 1938, 688—692; cf. A., 1937, I, 561).—The adsorption of KCl, NaOBz, and methylene-blue on pure sugar C activated at different temp. has been measured. The curves showing adsorption per unit area are continuous, base being adsorbed for activation temp. < 500°, and acid for higher temp. No mol. adsorption occurs with KCl. The results as a whole are such as would be expected on the surface oxide theory, but the latter does not account for the fact that all three salts show zero hydrolytic adsorption for C activated at 500°. F. L. U.

**Adsorption [of ions] during the precipitation of ferric hydroxide.** R. CHEVALLIER and S. MATHIEU (Compt. rend., 1938, 206, 1249—1251).—As a preliminary to a study of the magnetic properties of Fe(OH)<sub>3</sub> the behaviour of the Fe<sup>+++</sup> ions in Fe<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> solution with increasing [OH'] has been studied. During pptn., the Fe(OH)<sub>3</sub> carries down adsorbed Fe<sup>+++</sup> and all the Fe is consequently removed before free OH' are observed. J. A. D.

**Diffusion of mercury on tin foil.** K. PRÜGEL (Z. Metallk., 1938, 30, 25—27).—On placing a drop of Hg on a piece of rolled Sn foil it spreads outwards by diffusion, forming an ellipse the major axis of which lies in the rolling direction; the rate of spreading is const. so long as any liquid Hg remains and thereafter is an exponential function of the time. On raising the temp. spreading is accelerated and the ellipse approaches a circle owing to annealing of the Sn. During the whole process the [Hg] decreases from 15 to 7 at.-% in passing from the centre to the edge of the drop. A. R. P.

**Anomalies in surface tension of paraffin chain salts.** N. K. ADAM and H. L. SHUTE (Trans. Faraday Soc., 1938, 34, 758—765).—Very dil. solutions of C<sub>16</sub>H<sub>33</sub>·SO<sub>3</sub>K, R·O·SO<sub>2</sub>Na, NMe<sub>3</sub>RBr and NR(C<sub>5</sub>H<sub>5</sub>)Br (R = C<sub>12</sub>H<sub>25</sub> and C<sub>16</sub>H<sub>33</sub>) exhibit a very slow fall of surface tension, the final val. of which is nearly the same as that of more conc. solutions. At a certain crit. concn., which is approx. that at which micelle formation begins to be detectable, the final val. is reached almost at once. A similar acceleration of the attainment of the final val. is produced in the dil. solutions by addition of inorg. salts. The effect is related to ageing of the surface and not of the bulk solution. F. L. U.

**Adsorption potentials at polar liquid-liquid interfaces.** G. EHRENSVÄRD and L. G. SILLÉN (Nature, 1938, 141, 788—789).—The p.d. observed when two aq. salt solutions are separated by a H<sub>2</sub>O-insol. org. liquid are due to an ion adsorption equilibrium between the aq. phases and the interfacial layer, and not to a partition equilibrium of electrolyte at the phase boundaries and stationary diffusion inside the org. liquid. A formula given for the p.d. of each interface agrees with experimental results. Ion adsorption equilibrium p.d. may play a part in taste and smell sensations and in the activity of local anaesthetics. L. S. T.

**Properties of detergent solutions. VII. Two-component systems of fatty acids in organic**

liquids. VIII. Interfacial activity of long-chain fatty acids and their xylene solutions. J. POWNEY and C. C. ADDISON (Trans. Faraday Soc., 1938, 34, 625—627, 628—634; cf. A., 1938, I, 191).—VII. Liquidus curves are given for mixtures of  $C_{16}H_{33}CO_2H$  with  $C_6H_6$ , xylene,  $NH_2Ph$ , and light petroleum, and for oleic and  $C_{10}$ ,  $C_{12}$ ,  $C_{14}$ ,  $C_{16}$ , and  $C_{18}$  saturated acids with  $C_6H_6$ . Ricinoleic and linoleic acids each form a limited miscibility system with  $C_6H_6$ .

VIII. Interfacial tension-concn. relations have been determined for oleic acid against aq. Na oleate and Na dodecyl sulphate containing varying amounts of NaOH, xylene-oleic acid mixtures against solutions of Na salts of oleic, ricinoleic, and linoleic acids, and xylene-fatty acid mixtures against  $H_2O$  and aq. Na oleate. The results are discussed. F. L. U.

Contact potentials of stearate films on metal surfaces. E. F. PORTER and J. WYMAN, jun. (J. Amer. Chem. Soc., 1938, 60, 1083—1094).—Contact potentials of X films (A., 1938, I, 76) increase with the no. of layers and may attain vals. of many v.; those of Y films are independent of the no. of layers and remain at a few hundred mv. Sudden, large jumps of potential can be produced by alternating the deposition of X and Y films. At room temp. high X-film potentials persist for many days. When Y films of Ba-Cu stearate are heated at 74—85° the potentials decrease by about 200 mv.; at about 85° their optical thickness decreases. Y films of Ca stearate behave similarly whilst X films at 115° increase in optical thickness and gradually become opaque, the potentials dropping to near zero. When heated at lower temp. the potentials persist at high vals. X-Rays produce large negative potentials with X or Y films; Y films (but not X) are discharged easily by dipping in  $H_2O$  or heating below the temp. at which the optical thickness changes. Similar results are obtained when the films function as one of the poles in a glow discharge, but either positive or negative potentials can be produced. The results are discussed in relation to theories of film structure. E. S. H.

Effect of drying conditions on the electrokinetic potential [of glass and cellulose nitrate]. K. KANAMARU, T. TAKADA, and K. MAEDA, (J. Cellulose Inst. Tokyo, 1938, 14, 132—136).—The  $\zeta$ -potentials of glass in  $H_2O$  and of cellulose nitrate in EtOH diminish with increasing duration of contact between solid and liquid. The initial potentials increase and the rates of diminution become more rapid when the material is more intensively dried. W. A. R.

Surface electrification due to the recession of aqueous solutions from hydrophobic surfaces. I. LANGMUIR (J. Amer. Chem. Soc., 1938, 60, 1190—1194).—The progressively increasing contact potentials observed (A., 1938, I, 76) during the building up of Ca stearate layers appear to be due to a surface charge on the uppermost monolayer. A theory for the potential distribution produced by these surface charges is given. With potential gradients of  $3 \times 10^6$  v. per cm. the contact potentials are found to increase at a linear rate of 70 mv. per layer if the no. of layers is  $\gg$  a few hundreds. E. S. H.

Viscosity of unimolecular films. D. G. DERVICHIAN and M. JOLY (J. Chem. Physics, 1938, 6, 226—227; cf. A., 1937, I, 358).—Using a surface viscosimeter of the same type as that employed in the recent work of Harkins, it is found that the surface flow per sec.  $\propto$  the difference in pressure and inversely  $\propto$  the length of the canal. There is no relation which corresponds with Poiseuille's law. Changes in state in unimol. layers can be followed by the method described. W. R. A.

Tough soap films and bubbles. G. A. COOK (J. Chem. Educ., 1938, 15, 161—166).—The formation of soap films and bubbles of increased stability has been investigated. The addition of a small, optimum amount of tannin prolongs the life of bubbles obtained from Castile soap + glycerol. Triethanolamine oleate solutions are superior to Castile soap solutions for open-air work. L. S. T.

Complex formation in lipid films. J. H. SCHULMAN, E. STENHAGEN, and E. K. RIDEAL (Nature, 1938, 141, 785).—Investigation by two new methods of the area changes in mixed films formed by injecting dil. solutions of cetyl sulphate, digitonin, etc. into the substrate ( $H_2O$ ) under monolayers of cholesterol etc. shows that the increased area of the film due to penetration of the injected substance is in a simple ratio 1:1 or 1:2, depending on the structure (ring or chain) of the org. mols. involved. In addition to surface pressure, bulk concn. of the penetrating agent and changes in  $p_H$  affect the formation and stability of certain complexes. L. S. T.

Unit of foaminess. J. J. BIKERMAN (Trans. Faraday Soc., 1938, 34, 634—638).—Apparatus is described in which a measured vol. of air is forced into a liquid through a porous septum. If  $V$  is the vol. of air introduced in  $t$  sec., and  $v$  is the average vol. of the resulting foam,  $vt/V$  is a const., independent of the rate of flow of air and of the size and shape of the apparatus, provided the amount of liquid is not too small. This const. is a natural measure of the foaminess of a liquid. Its val. for two specimens of  $Bu^oOH$  is recorded. F. L. U.

Molecular interaction in monolayers. J. MARSDEN and J. H. SCHULMAN (Trans. Faraday Soc., 1938, 34, 748—758).—Force-area relations and surface potentials have been determined for monolayers of equimol. binary mixtures of stearic acid,  $\Delta^o$ -isoleic acid, cetyl alcohol, octadecylamine, and Me octadecyl ether. The measurements indicate that the forces between polar groups in mixed films are coulomb forces acting between (1) ions of like sign, (2) ions of unlike sign, (3) ion and dipole, (4) dipole and dipole. Variation of the  $p_H$  of the substrate causes changes in lateral adhesion due to changes in the degree of ionisation of polar groups. F. L. U.

Capillary systems. XIX (8). Permeability of coherent and compact material for gaseous and dissolved substances. E. MANEGOLD (Kolloid-Z., 1938, 83, 146—162; cf. B., 1938, 602).—Data are collected and discussed for the permeability of Pd, Pt, Cu, Fe, Ni, Al, Zn, and Pb for  $H_2$ ; porous Cu for  $H_2$ ,  $CH_4$ ,  $C_2H_6$ ,  $N_2$ ,  $CO_2$ ,  $n-C_5H_{12}$ ,  $Et_2O$ ,  $C_6H_6$ ,

and aq. sucrose; agar gels, zeolites, pyrometer tubes, films of linseed oil and of soap for various gases.

F. L. U.

**Nature of solutions and their behaviour under high pressures.** R. E. GIBSON (Sci. Month., 1938, 46, 1—17).—A lecture.

F. L. U.

**Dialysis and Brintzinger's method of dialysis.** W. RATHJE (Ber., 1938, 71, [B], 880—890).—Under the influence of osmotic and hydrostatic pressure the vol. of a solution alters during dialysis, thereby causing abnormally large coeffs. of dialysis in determinations of mol. wt. by the dialysis method of Brintzinger. With increase in the difference of concn. the rate of dialysis increases. Determinations of mol. size can be made therefore only when the osmotically active concn. of the comparison material is equal to that of the substance under examination. The rate of dialysis diminishes as the concn. of the external solution increases. This is attributed to increasing association as the concn. increases. H. W.

**Measurement of particle size by the X-ray method.** F. W. JONES (Proc. Roy. Soc., 1938, A, 166, 16—43).—A theoretical treatment of the problem based on observations of the breadth of the diffraction lines on powder photographs is given. The data for colloidal Au indicate particles of dimensions  $703 \times 176 \times 176$  Å. The effect of variation of particle size in the sample is discussed.

G. D. P.

**Colloidal silver. I. Ultramicroscopy, properties, and degree of dispersion.** R. SPYCHALSKI (Kolloid-Beih., 1938, 47, 321—370).—The prep. of Ag sols by reduction of solutions (Ag 0.001%) of  $\text{Ag}_2\text{O}$  and  $\text{AgNO}_3$  with  $\text{N}_2\text{H}_4 \cdot \text{H}_2\text{O}$  and  $\text{N}_2\text{H}_4 \cdot \text{H}_2\text{SO}_4$  is described. Unidisperse and reproducible sols can be obtained from  $\text{Ag}_2\text{O}$  and  $\text{N}_2\text{H}_4 \cdot \text{H}_2\text{O}$ , and from  $\text{AgNO}_3$  and  $\text{N}_2\text{H}_4 \cdot \text{H}_2\text{SO}_4$ . The degree of dispersion is largely determined by the  $[\text{Na}_2\text{CO}_3]$  present, and is higher with  $\text{N}_2\text{H}_4 \cdot \text{H}_2\text{SO}_4$  than with  $\text{N}_2\text{H}_4 \cdot \text{H}_2\text{O}$ . The particles can be counted (slit ultramicroscope) with an error of 10—15% if the sols are unidisperse; otherwise very inaccurate results are obtained. Sols made by reducing  $\text{AgNO}_3$  solutions with P in  $\text{Et}_2\text{O}$  are amicronic and can be used to prepare unidisperse sols of a required particle size in a way precisely similar to Zsigmondy's if  $\text{AgNO}_3$  (but not  $\text{Ag}_2\text{O}$ ) is used as the source of Ag.

F. L. U.

**Preparations of gold sols for Lange test.**—See A., 1938, III, 625.

**Stability of dispersions.** J. C. CARRUTHERS (Trans. Faraday Soc., 1938, 34, 646—649).—It is pointed out that, in general, org. substances which give stable dispersions in  $\text{H}_2\text{O}$  have a high mol. wt. and low volatility, whilst the converse is true of those which give unstable dispersions. The suggestion that a labile surface layer of mols. may be unable to retain adsorbed stabilising ions is supported by the results of mobility measurements with  $\text{C}_6\text{H}_{14}$  and  $\text{C}_{18}\text{H}_{38}$ , the latter having the higher mobility. In mixtures of the two,  $\text{C}_{18}\text{H}_{38}$  can immobilise the surface mols. of  $\text{C}_6\text{H}_{14}$ , so that a mixture with 90% of  $\text{C}_6\text{H}_{14}$  can be emulsified whereas pure  $\text{C}_6\text{H}_{14}$  cannot.

F. L. U.

**State of solution of soaps. I. Specific volumes of dilute sodium oleate solutions.** M. ULMANN (Z. physikal. Chem., 1938, 182, 18—30).—The sp. vols. ( $v$ ) of 0.005—16.85% aq. solutions of Na oleate show three well-defined regions over which  $v$  is a linear function of concn., transition between these regions occurring at about 0.03% and 0.9%. For concns. between these limits solutions show thixotropic behaviour, since shaking the solutions reduces  $v$ , the original val. of which returns after a few days. With 1.6% solutions an increase in  $v$  occurs during passage from sol to gel. The similarity of this behaviour to that of high org. polymerides (e.g., a cellulose acetate) is discussed.

J. W. S.

**Influence of ultrasonic waves on viscosity of colloidal solutions.** H. FREUNDLICH and D. W. GILLINGS (Trans. Faraday Soc., 1938, 34, 649—660).—A study of the action of ultrasonic waves on a no. of colloidal solutions shows that the  $\eta$  is affected only in such solutions as exhibit structural viscosity. The effect is usually, but not invariably, due to the collapse of cavities, and is reversible in cases where the decrease of  $\eta$  is due to disintegration of the gross structure. With some substances (cotton-yellow) destruction of the individual particles, and with others (Na stearate) condensation of small particles to rod-like aggregates, occurs. Anomalous  $\eta$  is not markedly affected by ultrasonic waves in  $\text{V}_2\text{O}_5$  or benzopurpurin sols. In gelatin and agar the reduction of  $\eta$  is not entirely prevented by avoiding the collapse of cavities.

F. L. U.

**Metal soaps and gelation of their paraffin solutions.** A. S. C. LAWRENCE (Trans. Faraday Soc., 1938, 34, 660—677).—The prep. and purification of a large no. of metal soaps are described. The following are new: *Be acetate, hexoate, dodecoate, stearate; NH<sub>4</sub> hexoate, octoate, stearate, elaidate; Na  $\alpha$ -bromostearate; Pb, Cs, UO<sub>2</sub>, Th, NH<sub>4</sub> triethanolamine stearates; Mg oleate; Na, K, Rb, Cs hexacosates.* Soaps at high temp. form (i) isotropic liquids of low  $\eta$  which on cooling may pass through the stages of (ii) highly viscous liquid, (iii) soft cryst., to (iv) hard cryst. One or both the intermediate stages may be omitted. The behaviour of soaps towards paraffin (Nujol) is strictly analogous to their behaviour on heating. Clear solutions are formed at temp. corresponding with stage (i), whilst separation of micro-crystals occurs below the temp. corresponding with (iv). In the intermediate range transparent elastic gels may be formed. Dry alkali metal soaps do not form gels, but pass directly from (i) to (iv). The last mol. of  $\text{H}_2\text{O}$  cannot be removed from them without decomp. Tables are given to show the gelation and transition temp. of the various soaps studied, and the mechanism of gelation is discussed.

F. L. U.

**Sol-gel transformations. III. Sols, jellies, and curds of sodium oleate.** E. HEYMANN (Trans. Faraday Soc., 1938, 34, 689—698; cf. A., 1936, 427).—The sp. vol. of Na oleate solutions at low concns. is equal to, and at higher concns. slightly >, that calc. from the components. The formation of curd, whether by swelling of dry soap in  $\text{H}_2\text{O}$  or from clear jelly, is accompanied by vol. contraction which

is attributed to hydration. There is no vol. change in the transition sol  $\rightleftharpoons$  clear jelly. F. L. U.

**Properties of dual emulsions.** D. F. CHEESMAN and A. KING (Trans. Faraday Soc., 1938, 34, 594—598).—By suitably varying the manner of shaking together amyl alcohol and  $H_2O$ , an oil-in- $H_2O$  or a  $H_2O$ -in-oil type of emulsion can be made at will. The relative stability of the two types has been determined when different emulsifying agents are present, and it is shown that the type other than that normally formed with a given emulsifying agent may possess a limited stability, which in one case is  $>$  that shown by the usual type. It thus appears that the same agent can in certain cases stabilise both types of emulsion. Similar results are recorded for kerosene- $H_2O$  mixtures. F. L. U.

**Isoelectric point of cellulose. Adsorption and swelling.** (MME.) J. GAVRET (Compt. rend., 1938, 206, 1299—1300).—The resistivity of a dil. buffer solution increases on immersion of cellulose, the increase being max. when the  $p_H$  of the buffer solution is 2.4—2.8; this is interpreted as the isoelectric point of cellulose (cf. also A., 1937, I, 408), the max. increase at this point being due to the min. swelling capacity, with consequent min. absorption of  $H_2O$ . The swelling capacity and adsorptive power increase rapidly for  $p_H > 2.8$ . A. J. E. W.

**Shape and size of methylcellulose molecules in solution, deduced from measurements with the ultracentrifuge and viscosimeter.** R. SIGNER and P. VON TAVEL (Helv. Chim. Acta, 1938, 21, 535—545).—The data for aq. solutions show that methylcellulose mols. of mol. wt. 14,100, 24,300, and 38,100 have a length of 560, 870, and 1190 and a thickness of 7.3, 7.9, and 8.6 Å., respectively. Mols. are at most slightly bent and are probably slightly, but only slightly, hydrated. R. S. C.

**Diffusion of cellulose derivatives.** A. POLSON (Kolloid-Z., 1938, 83, 172—180).—The diffusion coeff. of cellulose acetate in  $CO_2$  and of methylcellulose (I) in aq. NaCl has been determined by an optical method (A., 1936, 563), using fractions of the latter substance for which the mol. wt. is known from sedimentation equilibrium measurements. The results obtained in the two ways agree. An expression is derived for the influence of swelling pressure on the rate of diffusion. The axial ratio of (I) mols. regarded as ellipsoids of revolution is calc. F. L. U.

**Dielectric properties of protein solutions. I. Carboxyhæmoglobin.** J. L. ONCLEY. **II. Water-soluble proteins of normal horse serum.** J. D. FERRY and J. L. ONCLEY (J. Amer. Chem. Soc., 1938, 60, 1115—1123, 1123—1131).—I. Factors determining the dielectric behaviour involve (1) the dielectric increment at low frequencies,  $\Delta\epsilon_0/g$ , which depends on the difference in polarity between the protein and solvent mols., (2) the dielectric increment at high frequencies,  $\Delta\epsilon_\infty/g$ , which depends mainly on the vol. and hydration of the protein mols., (3) the crit. frequency,  $\nu_c$ , which depends mainly on the size and shape of the mols. and the viscosity of the solvent. The determination of these quantities by measurement of  $\epsilon$  with a radio frequency bridge is described.

Results for solutions of cryst. carboxyhæmoglobin are:  $\Delta\epsilon_0/g$  0.33,  $\Delta\epsilon_\infty/g$  -0.11,  $\nu_c$   $1.9 \times 10^8$  cycles per sec., suggesting a dipole moment of about 500 Debye units, and an orienting dipole of mol. wt. 66,700.

**II. The dielectric consts. of solutions of pseudo-globulin (I) and several cryst. fractions of albumin from normal horse serum have been determined over a wide frequency range. All these proteins increase the static  $\epsilon$  of  $H_2O$ . The  $\epsilon$  increments for the serum-albumins increase with increasing solubility in aq.  $(NH_4)_2SO_4$ ; the increment for (I) is much greater. The  $\epsilon$  increments per g. are of the same order as for  $NH_2$ -acids, increasing from 0.1 for the least polar albumin to 1.1 for the (I) (7000—160,000 per mol.). The variation of  $\epsilon$  increment with frequency for all the albumins deviates only slightly from the theoretical Debye curve with a crit. frequency of 0.85 megacycle. The dispersion of the  $\epsilon$  increment of the (I) solutions deviates slightly from a Debye curve with a crit. frequency of 0.24 megacycle. The relaxation times calc. from these crit. frequencies are  $\gg$  would be calc. from the mol. wts. on the basis of present theories.**

E. S. H.

**Alginate acid. I. Constitution.** G. LUNDE, E. HEEN, and E. ÖY. **II. X-Ray study of spun threads of alginate acid.** H. KRINGSTAD and G. LUNDE. **III. Viscosimetric determination of mol. wt.** E. HEEN (Kolloid-Z., 1938, 83, 196—202, 202—203, 204—210).—I. Analysis of carefully purified alginate acid and of its Na salt confirms the view that the chemical unit is manuronic acid anhydride and not the acid itself.

**II. Fibre diagrams of stretched threads of Na alginate disclose orientation and render it probable that the acid has a structure similar to that of cellulose.**

**III. The sp.  $\eta$  of solutions of alginate acid is a max. at  $p_H$  7 and reaches a const. val. in about 2N-NaOH. The mol. wt. calc. by Staudinger's formula corresponds with a chain length of about 80 hexuronic acid units.** F. L. U.

**Liesegang rings and related phenomena. Material nature of light.** C. SCHUYTEN (Rev. gén. Sci., April 15, 1938, Reprint, pp. 3—14).—Observations of the growth of discs and rings of  $Ag_2CrO_4$  indicate that these represent the final stage of a spiral rather than a discontinuous process. This accounts for the anastomoses generally visible in a ring system formed in a flat dish. The similarity of pattern shown by Liesegang rings, rings formed by evaporating solutions of solids, and Newton's rings is held to be due to a common cause. F. L. U.

**Precipitation of tricalcium phosphate by urease.**—See A., 1938, III, 615.

**Growth of metal trees in gels. I. Morphology of lead tree.** A. KING and N. STUART (J.C.S., 1938, 642—654).—Growth of arboreal structures of Pb in  $SiO_2$  gels containing  $Pb(OAc)_2$  is induced by reduction with Sn, Zn, Al, Mg, Mn, Cr, Cd, Fe, and Cu, but not with Co or Ni.  $Pb(NO_3)_2$  is not reduced by Sn under these conditions, nor is  $Pb(OAc)_2$  reduced by Sn in  $SiO_2$  sol before the occurrence of gelation. Sn produces widely different types of growth depending on the concn. of Pb in the gel. Other colloidal

materials inhibit or modify the growth in an unpredictable manner. F. L. U.

**Theory of structure viscosity. III. Flow of plastic substances.** W. PHILIPPOFF (Kolloid-Z., 1938, 83, 163—172; cf. A., 1936, 788).—The  $\eta$  and fluxional birefringence of a no. of liquids have been studied in capillary tubes of various diameters. Na oleate (33%) and 2 days old  $V_2O_5$  sol exhibit stationary laminar flow.  $V_2O_5$  sol aged for 1 year behaves abnormally on account of the presence of "swarms" which are broken up only at high rates of shear. Cellulose acetate in  $CH_2Ph \cdot OH$  and an oil paint (50% ZnO in linseed oil varnish) show non-laminar flow in consequence of slipping at the wall of the capillary. The anomalous flow of sols of mercuri-sulphosalicylic acid and cotton-yellow is due to gross heterogeneity caused by the breaking up and syneresis of masses of gel. It is possible to distinguish between ordinary non-Newtonian liquids, disintegrated gels, cybotactic sols, and conc. suspensions only by experiments with capillaries of varying dimensions, since the flow characteristics of the last three systems are not independent of the apparatus dimensions. F. L. U.

**Adhesion of particles of microscopic size. VII. Adhesion of barium sulphate particles in electrolyte solutions.** A. VON BUZÁGH and Z. SZABÓ (Kolloid-Z., 1938, 83, 139—146; cf. A., 1936, 1064).—The adhesion of particles of  $BaSO_4$  in homogeneous dispersions has been measured by the tilting-plate method in  $H_2O$  and electrolyte solutions. In  $H_2O$  the adhesion is a min. for particles of about  $5 \mu$  radius, and approaches a limit beyond  $30 \mu$ . The influence of electrolytes on adhesion is exactly parallel with their influence on the electrokinetic behaviour, in the sense that the adhesion is greatest when the mobility is least. The usual lyotropic effects are observed.  $Ba^{++}$  and  $SO_4^{--}$  ions exert an exceptionally large influence. F. L. U.

**Reaction isotherm.** A. BANCHETTI (Gazzetta, 1938, 68, 192—195).—Various methods of calculating the max. work obtainable from an isothermal reaction by means of the van 't Hoff equilibrium box are discussed. O. J. W.

**Limits of applicability of the Gibbs-Helmholtz equation and derivation of a general equation valid for cells which operate either reversibly or irreversibly and with the volume either constant or variable during operation.** O. SCARPA (Gazzetta, 1938, 68, 113—117).—A general expression for the e.m.f. of an electrochemical cell is derived. For the case of a reversible process and const. vol. this expression becomes identical with the Gibbs-Helmholtz equation. O. J. W.

**Energy relations in aqueous solutions of inert gases.** E. LANGE and R. WATZEL (Z. physikal. Chem., 1938, 182, 1—17).—Theoretical. The energy changes involved during dissolution of a gas in  $H_2O$  are discussed, and, from solubility data, thermal and entropy changes for solutions of He, Ne, Ar, Kr, Xe, and Rn in  $H_2O$  at various temp. are deduced. J. W. S.

**Dissociation of nitric acid.** O. REDLICH (Z. physikal. Chem., 1938, 182, 42—47; cf. A., 1936, 799).—New measurements of the variation in the intensity of the strongest  $NO_3'$  line in the Raman spectrum of  $HNO_3$  at various dilutions (A., 1937, I, 598) lead to a val. of the dissociation const. of  $HNO_3$  which agrees with vals. deduced from the absorption spectrum of  $HNO_3$  (A., 1928, 590) and from the influence of  $HNO_3$  on the absorption spectrum of 2:4-dinitrophenol (A., 1938, I, 81). It is inferred that the divergencies reported are not due to ionic hydration but are attributable to some sp. effect of  $H^+$  other than formation of undissociated  $HNO_3$  mols. J. W. S.

[Dissociation of nitric acid.] H. VON HALBAN and M. SEILER (Z. physikal. Chem., 1938, 182, 48; cf. A., 1938, I, 81, and preceding abstract).—The views of the authors and of Redlich are now reconciled. J. W. S.

**Dissociation relationships of disubstituted succinic acids.**—See A., 1938, II, 216.

**Dissociation constants of acids in mixtures of light and heavy water.** P. GROSS (Z. Elektrochem., 1938, 44, 299—301).—Theoretical. It is shown that the assumptions made by Schwarzenbach (A., 1938, I, 139) can be deduced from the treatment of Gröss *et al.* (A., 1936, 802). F. J. G.

**Acid dissociation constants in dioxan-water mixtures by potentiometric titration.** C. C. LYNCH and V. K. LA MER (J. Amer. Chem. Soc., 1938, 60, 1252—1259).—The dissociation consts. of  $AcOH$ ,  $EtCO_2H$ ,  $PrCO_2H$ , and  $BzOH$  have been determined by potentiometric titration in dioxan- $H_2O$  mixtures of dielectric const. 34.3, 21.0, and 11.7, respectively. Addition of  $LiCl$  was found necessary for adequate conductivity but by determining the dissociation consts. in presence of progressively decreasing  $[LiCl]$  and extrapolating to zero, vals. for the mixed solvent without added neutral salt have been obtained. The logs of the extrapolated consts. (except for  $BzOH$ ) are linear functions of the reciprocal of the dielectric const. from 78 to 21. Weak acids, insol. in  $H_2O$  (e.g., abietic and stearic acids), can be titrated directly in 80% dioxan. E. S. H.

**Slow hydrolysis of ferric chloride in dilute solution. II. Change in hydrogen-ion concentration.** A. B. LAMB and A. G. JACQUES (J. Amer. Chem. Soc., 1938, 60, 1215—1225; cf. A., 1938, I, 312).—The change in  $[H^+]$  has been followed by measurements with the glass electrode. The results support the conclusions previously derived from measurements of conductance and colour. Calculations have been made of the first and second hydrolysis consts. of  $FeCl_3$  and of the relative amounts of unhydrolysed as well as partly and completely hydrolysed salt over a wide range of concn. Undissociated  $Fe(OH)_3$  is the only substance which increases in concn. with decreasing over-all concn. of the salt. It is deduced that the primary product of hydrolysis is a dil. supersaturated solution of  $Fe(OH)_3$ , the coagulation of which to colloidal particles is the controlling, relatively slow, step of the reaction. In the initial stages of slow hydrolysis, where the speed of hydrolysis is limited by the rate of formation of



nuclei, the speed  $\propto [\text{Fe}(\text{OH})_3]^2$ , in accordance with the Smoluchowski theory of rapid coagulation.

E. S. H.

**Equilibrium  $\text{Pb} + \text{SnBr}_2 \rightleftharpoons \text{PbBr}_2 + \text{Sn}$  in aluminium bromide as solvent.** J. K. DELIMARSKI (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, 4, 443—458).—In the above reaction at 360° Sn is considerably nobler than Pb. Owing to complications introduced by the solvent, the observed equilibria do not agree with those calc. from the apparent active masses.

F. L. U.

**Gas-liquid equilibrium for the system methane-butane.** G. W. NEDERBRAGT (Ind. Eng. Chem., 1938, 30, 587—588).—The mol. fraction ratios for  $\text{CH}_4$  and  $n\text{-C}_4\text{H}_{10}$  in the gas and liquid phases have been determined. The vals. at 10 atm. are 12.8 and 0.082 at  $-16.5^\circ$ , 16.6 and 0.22 at  $16^\circ$ , 20.0 and 0.44 at  $38^\circ$ ; at 20 atm., 6.7 and 0.049 at  $-21^\circ$ , 8.6 and 0.14 at  $17^\circ$ , 10.1 and 0.25 at  $39^\circ$ ; at 30 atm., 4.8 and 0.049 at  $-18^\circ$ , 5.6 and 0.12 at  $14.5^\circ$ , 6.6 and 0.22 at  $43^\circ$ . The vals. for  $\text{CH}_4$  agree approx. with published vals. for mixtures of  $\text{CH}_4$  with  $\text{C}_3\text{H}_8$  (A., 1934, 490; B., 1934, 949), and with  $\text{C}_2\text{H}_6$ ,  $\text{C}_6\text{H}_{14}$ , and  $\text{C}_7\text{H}_{16}$  (A., 1936, 1333; B., 1936, 1076), whence it is inferred that they will also apply to natural gasolines since these are mixtures of lower paraffins.

R. C. M.

**Thermal studies of binary and ternary mixtures. I. Binary system acetanilide-phenacetin.** G. ULISSE (Boll. Chim. farm., 1938, 77, 212—214).—The m.p. curve of  $\text{NHPhAc}$  (I)-phenacetin mixtures shows a max. corresponding with a 4:1 mol. compound [75% of (I)]. This compound forms a binary system with (I), yielding a eutectic mixture, m.p.  $83^\circ$ , containing 76.4% of (I).

F. O. H.

**System  $\text{As}_2\text{O}_5\text{-BaO-H}_2\text{O}$  at  $17^\circ$ . Characterisation of a new barium arsenate,  $\text{BaO}\cdot 2\text{As}_2\text{O}_5\cdot 3\text{H}_2\text{O}$ .** H. GUÉRIN (Compt. rend., 1938, 206, 1300—1303; cf. A., 1926, 358; 1937, I, 474).—A ternary diagram for the system is discussed. The compounds  $\text{Ba}_3(\text{AsO}_4)_2\cdot x\text{H}_2\text{O}$ ,  $\text{Ba}_2\text{H}_2(\text{AsO}_4)_2\cdot 2\text{H}_2\text{O}$ ,  $\text{BaH}_4(\text{AsO}_4)_2\cdot \text{H}_2\text{O}$ ,  $\text{BaH}_4(\text{AsO}_4)_2$  (I), and  $\text{BaO}\cdot 2\text{As}_2\text{O}_5\cdot 3\text{H}_2\text{O}$  (II) occur as solid phases, (II) being formed from (I), which occurs only in false equilibrium.

A. J. E. W.

**System  $\text{Na}_2\text{HPO}_4 + 2\text{NH}_4\text{Cl} \rightleftharpoons (\text{NH}_4)_2\text{HPO}_4 + 2\text{NaCl}$ .** R. LAUFFENBURGER and M. BRODSKY (Compt. rend., 1938, 206, 1383—1385).—Equilibrium diagrams for the system at  $0^\circ$  and at  $25^\circ$  are given.  $\text{NaNH}_4\text{HPO}_4\cdot 4\text{H}_2\text{O}$  has the largest region of stability at these temp.

A. J. E. W.

**Ternary systems. XXIII. Solid solution among the picromerite double salts at  $25^\circ$ . Zinc, copper, and nickel ammonium sulphates.** A. E. HILL and W. J. TAYLOR, jun. (J. Amer. Chem. Soc., 1938, 60, 1099—1104; cf. A., 1938, I, 252).—The systems  $\text{ZnSO}_4\text{-(NH}_4)_2\text{SO}_4\text{-H}_2\text{O}$  and  $\text{NiSO}_4\text{-(NH}_4)_2\text{SO}_4\text{-H}_2\text{O}$  have been investigated at  $25^\circ$ . The formation of solid solutions between pairs of the salts  $\text{CuSO}_4\text{-(NH}_4)_2\text{SO}_4\cdot 6\text{H}_2\text{O}$ ,  $\text{ZnSO}_4\text{-(NH}_4)_2\text{SO}_4\cdot 6\text{H}_2\text{O}$ , and  $\text{NiSO}_4\text{-(NH}_4)_2\text{SO}_4\cdot 6\text{H}_2\text{O}$  has been studied, and the equilibrium distribution of salts between liquid and solid solutions determined. The mol. concns. in the

liquid and solid phases are related approx. by an exponential equation, in which the exponent approaches 1 when the aq. solubilities of the salts are equal and diminishes as the ratio of the solubilities increases.

E. S. H.

**Binary and ternary solutions of nitrates in anhydrous acetic acid.** A. W. DAVIDSON and H. A. GEER (J. Amer. Chem. Soc., 1938, 60, 1211—1214).—Solubility data are recorded for  $\text{LiNO}_3$  in  $\text{AcOH}$  at  $39\text{--}132^\circ$ , and for  $\text{Ca}(\text{NO}_3)_2$  at  $30\text{--}34^\circ$ . The isolation of  $\text{Ca}(\text{NO}_3)_2\cdot 3\text{AcOH}$  is reported. Solubility data for the systems  $\text{AgNO}_3\text{-NH}_4\text{NO}_3\text{-AcOH}$  at  $40\text{--}90^\circ$  and  $\text{AgNO}_3\text{-LiNO}_3\text{-AcOH}$  at  $30^\circ$  are recorded; in the former system  $\text{AgNO}_3\cdot \text{NH}_4\text{NO}_3$  occurs as a stable solid phase over a small concn. range.

E. S. H.

**Relative partial molal heat content of sodium bromide in aqueous solutions at  $25^\circ$ .** A. L. ROBINSON (J. Amer. Chem. Soc., 1938, 60, 1265).—Data calc. from e.m.f. measurements (A., 1937, I, 617) are in fair agreement with those derived from calorimetric measurements (A., 1932, 998).

E. S. H.

**Free energy of acetylene.** A. R. GORDON (J. Chem. Physics, 1938, 6, 219—220).—The free energy of  $\text{C}_2\text{H}_2$  has been calc. from spectroscopic data. Equilibrium consts. have been evaluated for the reactions:  $2\text{C} + \text{H}_2 = \text{C}_2\text{H}_2$ ;  $\text{C}_2\text{H}_2 + \text{N}_2 = 2\text{HCN}$ .

W. R. A.

**A priori calculation of the calorific power of hydrocarbons.** M. BRUTZCUS (Compt. rend., 1938, 206, 1291—1294; cf. A., 1937, I, 364).—General formulæ for the calculation of the calorific power of any hydrocarbon are given, and their agreement with experimental data is demonstrated.

A. J. E. W.

**Heats of sublimation.** K. L. WOLF and H. WEGHOFFER (Z. physikal. Chem., 1938, B, 39, 194—208).—Heats of sublimation for 55 and heats of fusion for 3 org. substances are recorded. Data for isomeric substances are compared. The heat of sublimation cannot in general be treated as the sum of the contributions of all the atoms and groups in the mol. Additivity is observed in certain cases, e.g., for  $\text{C}_6\text{H}_6$ ,  $\text{C}_{10}\text{H}_8$ , and  $\text{C}_{14}\text{H}_{10}$ . Factors which influence the val. of the heat of sublimation are discussed.

H. J. E.

**Thermal data. IX. Heats of combustion of hippuric and succinic acids and a proposal for the use of hippuric acid as a secondary standard in combustion calorimetry.** H. M. HUFFMAN (J. Amer. Chem. Soc., 1938, 60, 1171—1177).—The isothermal heats of combustion of succinic and hippuric acids at  $25.0^\circ$  are 3023.1 and 5628.6 g.-cal. per g., respectively. Heats of formation are calc. The use of hippuric acid, cryst. from  $\text{H}_2\text{O}$ , as a secondary standard is proposed for investigations on compounds containing N.

E. S. H.

**Heats of combustion, refractive data, and alkaline hydrolysis of the ethyl cis-pentenoates.**—See A., 1938, II, 258.

**Electrochemical study of antimony trichloride in chlorobenzene and nitrobenzene solutions of aluminium bromide.** E. J. GORENBEIN (J. Gen.

Chem. Russ., 1938, 8, 233—240).—Sp. conductivity  $\kappa$  rises in the system  $\text{SbCl}_3\text{--AlBr}_3\text{--PhCl}$  with increasing concn. of the complex  $\text{SbBr}_3\text{,AlBr}_3$  (I). In  $\text{PhNO}_2$   $\kappa$  is max. when the concn. of (I) is 32%. Mol. conductivity in  $\text{PhCl}$  falls, and in  $\text{PhNO}_2$  rises, with increasing dilution. Sb is deposited at the cathode, at a decomp. potential of 1.02 v. (in  $\text{PhCl}$ ). The reaction  $\text{AlBr}_3 + \text{SbCl}_3 \rightleftharpoons \text{AlCl}_3 + \text{SbBr}_3$  is established. R. T.

**Electrochemical study of systems  $\text{AlBr}_3\text{--EtBr}$  and  $\text{AlBr}_3\text{--EtBr--KI}$ .** I. L. KATZNELSON (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, 4, 393—404).—The sp. conductivity ( $\kappa$ ) of  $\text{AlBr}_3\text{--EtBr}$  mixtures is a max. for  $\text{AlBr}_3/\text{EtBr} = 0.66$ . The decomp. potential is 1.98 v. Addition of KI increases  $\kappa$ , the increase showing a max. at a certain  $\text{AlBr}_3/\text{EtBr}$  ratio. Electrolysis leads to deposition of Al and I with a current yield of 80% at the cathode. The decomp. voltage, 1.28, exceeds the calc. by 0.26 v. F. L. U.

**Electrochemical properties of melts of  $\text{LiCl--AlBr}_3$ ,  $\text{NaCl--AlBr}_3$ ,  $\text{KCl--AlBr}_3$ , and  $\text{AgCl--AlBr}_3$ .** J. P. MESHENNI (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, 4, 413—426).—The conductivity of fused  $\text{AlBr}_3$  increases on the addition of alkali chlorides in proportion to the mobility of the added cation. The temp. coeff. is positive. The decomp. voltage is the same for all the mixtures containing alkali halides. Al is deposited on the cathode. F. L. U.

**Electrochemical properties of systems  $\text{LiCl--AlBr}_3\text{--EtBr}$ ,  $\text{NaCl--AlBr}_3\text{--EtBr}$ ,  $\text{KCl--AlBr}_3\text{--EtBr}$ , and  $\text{AgCl--AlBr}_3\text{--EtBr}$ .** J. P. MESHENNI (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, 4, 427—442; cf. preceding abstract).—The alkali chlorides are sol. in  $\text{EtBr}$  in presence of  $\text{AlBr}_3$ , their solubility increasing in the order  $\text{K} < \text{Na} < \text{Li}$ . The conductivity of the solutions is increased in the order  $\text{Li} < \text{Na} < \text{K}$ . Other properties are described. F. L. U.

**Theoretical study of ion transport by a current of vapour for the production of high potentials.** J. VIRGITT (Compt. rend., 1938, 206, 1367—1369).—A method suggested for the production of high potentials, involving the collection of charges from a stream of gaseous ions (cf. *ibid.*, 1935, 201, 1332), is shown to be impracticable. A. J. E. W.

**Theoretical bases for the electrochemical properties of liquid ammonia.** S. MAKISHIMA (J. Fac. Eng. Tokyo, 1938, 21, 115—168).—The author's theory (A., 1935, 1325) is applied to solutions in liquid  $\text{NH}_3$ . The solubility product law holds for solutions of halides in liquid  $\text{NH}_3$ , and the vals. of the solubility product, heat of dissolution of gaseous ions, and entropy change during solvation are deduced for a no. of salts. Solubilities in  $\text{NH}_3$  are compared with those in  $\text{H}_2\text{O}$ . The normal potentials of metal and halogen electrodes in  $\text{NH}_3$  are lower with respect to the  $\text{H}_2$  electrode than in  $\text{H}_2\text{O}$ . The effects observed are attributed to chemical, rather than electrostatic, solvation effects. The dissociation const. of  $\text{NH}_3$  at  $-34^\circ$  is about  $5 \times 10^{-34}$ , and it is deduced that the normal potential of the  $\text{N}_2$  electrode is  $-1.5$  v. It is assumed that alkali metals dissolved in liquid

$\text{NH}_3$  split into solvated metal ions and electrons, and the solubility product, heat of solvation of electrons, and their entropy are deduced. The blue colour of the solutions is in accord with the view that absorption is due to the solvated electrons. High  $\text{H}_2$  and  $\text{N}_2$  overpotentials are observed at Pt electrodes during electrolysis in  $\text{NH}_3$ , and these permit the electrodeposition of metals such as Be, Al, and rare-earth metals, and the occurrence of unusual electrolytic reduction reactions. J. W. S.

**Electrochemical behaviour of metals which furnish cations of different valency. II.** R. PRONTELLI (Gazzetta, 1938, 68, 173—178; cf. A., 1937, I, 245).—A general expression is derived for the equilibrium const. between a metal and its ions in two valency states. Data for Cu and Ag give good agreement with the theory. O. J. W.

**Normal potential of deuterium and ionic equilibria in mixtures of  $\text{H}_2\text{O}$  and  $\text{D}_2\text{O}$ .** G. SCHWARZENBACH (Z. Elektrochem., 1938, 44, 302).—A reply to Abel and Redlich (A., 1938, I, 254). Reasons are given for the belief that the cell  $\text{D}_2|\text{DCl}$  in  $\text{D}_2\text{O}|\text{KCl}$  (sat.) in  $\text{H}_2\text{O}|\text{HCl}$  in  $\text{H}_2\text{O}|\text{H}_2$  gives a closer approximation to the normal potential of D than does the cell  $\text{D}_2|\text{DCl}$  in  $\text{D}_2\text{O}|\text{AgCl}$ , Ag,  $\text{AgCl}|\text{HCl}$  in  $\text{H}_2\text{O}|\text{H}_2$ . F. J. G.

**Meaning and standardisation of the  $p_{\text{H}}$  scale.** D. A. MACINNES, D. BELCHER, and T. SHEDLOVSKY (J. Amer. Chem. Soc., 1938, 60, 1094—1099).—E.m.f. of cells of the type  $\text{H}_2(\text{Pt})|\text{buffer solution}$ ,  $\text{KCl}$  (sat.),  $\text{KCl}$  (0.1N),  $\text{Hg}_2\text{Cl}_2|\text{Hg}$  have been determined at  $12^\circ$ ,  $25^\circ$ , and  $38^\circ$ , and the results interpreted for the purpose of obtaining vals. of  $E_0$  in the equation  $p_{\text{H}} = (E - E_0)/(2.3026RT/F)$ . The  $p_{\text{H}}$  vals. of acetate and phthalate buffers have been redetermined at the above temp. E. S. H.

**Polarisation of a calomel electrode.** (LORD) ROTHSCCHILD (Proc. Roy. Soc., 1938, B, 125, 283—290).—Polarisation is defined as the production of a thermodynamically irreversible potential at the surface of an electrode; the difference in polarisability between a calomel and any other type of electrode is one of degree only. Measurement of the p.d. between the electrode being examined and a reference electrode at intervals during the passage of currents of known strengths shows that the max. c.d. which an anodic calomel electrode will sustain over a period of 5 hr. without polarisation is  $15 \mu\text{a.}$  per sq. cm. F. B. P.

**Oxidation-reduction potentials in heterogeneous systems.** I. M. KORR (J. Cell. Comp. Physiol., 1938, 11, 233—245).—The addition of an adsorbent to a solution of a dye causes a change in the oxidation-reduction potential measured with a Pt electrode. The direction of the change varies with the  $p_{\text{H}}$ , depending on whether the oxidant or reductant is adsorbed. Similar differences may be observed with a quinhydrone electrode. It follows that the redox potential at an interface may differ from that existing in the aq. phase. V. J. W.

**Electrolytic thermal chains.** J. J. HERMANS (Z. physikal. Chem., 1938, 182, 49—53).—The conclusions of Szabó (A., 1938, I, 143) are criticised on

the grounds that activity corrections are only incompletely applied, the relationship with the Peltier heat and the heat of transfer is incorrectly deduced, and that no definite conclusions concerning the ionic activities are possible.

J. W. S.

**Electrolytic thermal chains.** Z. SZABÓ (Z. physikal. Chem., 1938, 182, 54).—A reply to Hermans (cf. preceding abstract).

J. W. S.

**Electrolysis of colloidal silver solutions.** M. CENTNERSZWER and (MLLE.) J. BOROWICZ (Bull. Acad. Polonaise, 1937, A, 530—545).—The particles of dialysed Ag sols prepared (i) by the action of P on ammoniacal AgNO<sub>3</sub>, (ii) by H<sub>2</sub> reduction of aq. Ag<sub>2</sub>O, contain, by ultramicroscopic count, ~10<sup>8</sup> Ag atoms, having an effective valency from sp. conductivities of 0.53—0.97, a result which is at variance with Pauli's colloid conceptions. Electrolysis between Pt electrodes with accompanying decomp. of H<sub>2</sub>O yields, for the (anode-seeking) colloidal Ag, electrochemical eqivs. of 3.6—9.8. These vals., and the mechanism whereby dendritic Ag is deposited at the cathode, are discussed.

I. McA.

**Electrochemistry of rusting process along a scratch-line on iron.** R. S. THORNHILL and U. R. EVANS (J.C.S., 1938, 614—621; cf. A., 1936, 36).—Apparatus for the direct measurement of currents near a scratch-line on Fe covered with filter-paper soaked in NaHCO<sub>3</sub> solution is described. Simultaneous measurements of the amount of corrosion show the latter to be mainly electrochemical, Fe<sup>II</sup> compounds being formed in the early stages in amount corresponding roughly with the current. The subsequent oxidation to Fe<sup>III</sup> compounds is shown to be also electrochemical under the conditions of the experiments.

F. L. U.

**Polarographic studies of organic compounds.** I. TACHI (Mem. Coll. Agric. Kyoto, 1938, No. 42, 2—63).—An account of previous work is given (A., 1937, I, 567, and previous abstracts). Abnormalities in the polarogram of camphor are due to its strong adsorption at the dropping Hg cathode. Of the three waves observed, the second is due to reduction, and the first and third to the formation and destruction of an oriented layer respectively. Reduction of bilirubin occurs in a single stage and requires 2 H atoms. The reduction potential in 2 × 10<sup>-4</sup>M solution at 25° is 1.464 v. negative to the N-calomel electrode. The solubility of bilirubin in a p<sub>H</sub> 7 buffer is about 9 mg. per l. Polarograms of the air-oxidation product indicate the presence of at least two, the more reducible of which is pptd. at p<sub>H</sub> > 5 and is regarded as biliverdin.

F. L. U.

**Polarographic researches on proteins.** R. BRDICKA (J. Chim. phys., 1938, 35, 89—98; cf. A., 1937, III, 205).—Polarographic curves show the presence of maxima on the addition of proteins in the electrolysis of solutions of NH<sub>4</sub> or Co salts. The maxima coincide with the evolution of H<sub>2</sub>, which in presence of the protein occurs at a lower overpotential. The effect of the protein is catalytic and associated with the presence of SH radicals. The mechanism of the action is discussed.

E. S. H.

**Properties of the oxides of nitrogen. VII. Flame propagation in the system dinitrogen pentoxide-ozone.** T. M. LOWRY and R. V. SEDDON (J.C.S., 1938, 626—631; cf. A., 1937, I, 521).—NO<sub>3</sub> is shown spectrographically to be present in a mixture of N<sub>2</sub>O<sub>5</sub> and O<sub>3</sub> undergoing slow decomp. as well as in the flame front in the explosive reaction. In the slow reaction  $-d[O_3]/dt = k[N_2O_5]^{1/2}[O_3]^{1/2}$ , the primary reaction being the unimol. decomp. of N<sub>2</sub>O<sub>5</sub> to NO<sub>2</sub> and NO<sub>3</sub>, followed by the decomp. of O<sub>3</sub> by NO<sub>2</sub>, the bimol. decomp. of NO<sub>3</sub>, and the reformation of N<sub>2</sub>O<sub>5</sub>. The same mechanism applies to the flame. For given conditions the plot of log  $P/T$  against  $1/T$  is a straight line ( $P$  = pressure,  $T$  = crit. explosion temp.); adiabatic self-propagation is due to the thermal energy liberated in the bimol. trioxide decomp.

M. R.

**Explosion regions. XXVII. Analogy between propagation of reactions in gas mixtures and that in mixtures of solid substances or in mixtures of gases and solid substances.** W. P. JORISSEN (Rec. trav. chim., 1938, 57, 467—486).—A résumé and discussion of previous results (cf. A., 1936, 32, 431, and earlier abstracts).

M. R.

**Paramagnetic conversion of para-hydrogen and ortho-deuterium in the presence of nitric oxide. (Magnetic moment of the deuteron.)** L. FARKAS and U. GARBATSKI (J. Chem. Physics, 1938, 6, 260—263).—The rates of the reactions  $p\text{-H}_2 + \text{NO} \rightleftharpoons o\text{-H}_2 + \text{NO}$  (1) and  $o\text{-D}_2 + \text{NO} \rightleftharpoons p\text{-D}_2 + \text{NO}$  (2) are compared. According to Wigner's theory the ratio of the velocities should be  $\propto \mu_H/\mu_D$ , where  $\mu_H$  and  $\mu_D$  are the magnetic moments of H and D. The ratio of the rates is in approx. agreement with Wigner's theory and also with that of Kalckar and Teller; no decision can be made regarding which of these theories is the better approximation. The velocity coeff. for (1) is approx. 10 times that of (2) at the same temp. Comparison of the conversion rates of both reactions with those in presence of O<sub>2</sub> shows that the ratios are the same but that the rates in NO are about 5 times the rates in O<sub>2</sub>. Assuming  $\mu_H = 2.46$  nuclear magnetons and  $\mu_H/\mu_D = 3.8$ ,  $\mu_D = 0.65$  nuclear magneton; this val. is compared with recorded vals.

W. R. A.

**Activation energy of diene association reactions.** M. G. EVANS and E. WARHURST (Trans. Faraday Soc., 1938, 34, 614—624; cf. A., 1938, I, 145).—Activation energies of diene association are calc. by the diabatic method and by treating the system as a six-electron problem. The latter leads to satisfactory results compared with experimental vals. for the addition of C<sub>2</sub>H<sub>4</sub> to butadiene. The failure of the first method and the cause of the abnormal temp.-independent factors of the reactions are discussed.

F. L. U.

**Velocity of the thermal cis → trans-conversion of azobenzene and derivatives.**—See A., 1938, II, 272.

**Thermal decomposition of n-octane.**—See A., 1938, II, 254.

**Stability of free radicals.**—See A., 1938, II, 253.

"Acidolysis" of esters. E. CHERBULIEZ and M. FULD (Arch. Sci. phys. nat., 1938, [v], 20, Suppl., 52—54).—As example of the reaction  $\text{RCO}_2\text{R}' + \text{R}''\text{CO}_2\text{H} \rightarrow \text{RCO}_2\text{H} + \text{R}''\text{CO}_2\text{R}'$ , the velocity with Et acetoacetate can be followed from the amount of  $\text{CO}_2$  resulting from the decomp. of the liberated acid. The rate is not a simple function of the strength of  $\text{R}''\text{CO}_2\text{H}$  as judged by its ionisation in  $\text{H}_2\text{O}$ ; the reaction is catalysed by  $\text{H}_2\text{O}$  and by conc.  $\text{H}_2\text{SO}_4$ , but not by gaseous  $\text{HCl}$ , this indicating that the mechanism is independent of traces of  $\text{H}_2\text{O}$ . M. R.

Velocity of the reaction:  $\text{CH}_2\text{Br}\cdot\text{COO}' + \text{S}_2\text{O}_3'' \rightarrow \text{S}_2\text{O}_3\cdot\text{CH}_2\cdot\text{COO}'' + \text{Br}'$ , in aqueous organic solvents. L. FILIPCZYK (Rocz. Chem., 1938, 18, 36—38).—The velocity of the reaction in aq. MeOH varies inversely with the  $[\text{MeOH}]$  to a concn. of 50%, above which it rises gradually. The activation energy is independent of the  $[\text{MeOH}]$ . R. T.

Reaction kinetics in films. Active agents in the aqueous halogenation of long-chain phenols. A. E. ALEXANDER (J.C.S., 1938, 729—734).—Measurements of surface pressure and surface potential by monolayer technique applied to *p*-hexadecyl-phenol on suitable substrates show that with aq. I, Br, and Cl solutions the active intermediates are the hypohalous acids and trihalide ions, activities being in the order  $\text{HOI} > \text{HOBr} > \text{HOCl}$  and  $\text{I}_3' < \text{Br}_3' < \text{Cl}_3'$ . Bulk phase experiments confirm these results.  $\text{HOCl}$  is approx. 0.001 as active as  $\text{Cl}_3'$ ,  $\text{HOI}$  is 1000 times as active as  $\text{I}_3'$  and  $\text{HOBr}$  is 0.25 as active as  $\text{Br}_3'$ . The equilibrium const.  $[\text{Cl}_2][\text{Cl}']/[\text{Cl}_3']$  is 0.23. M. R.

Hydrolysis of sucrose. P. M. LEININGER and M. KILPATRICK (J. Amer. Chem. Soc., 1938, 60, 1268).—In the inversion of 2% sucrose by  $\text{HCl}$  at 0—10° the energy of activation varies from 24.2 kg.-cal. at 4.842M- $\text{HCl}$  to 26.2 kg.-cal. at 1.1235M- $\text{HCl}$ . E. S. H.

Unimolecular rates of hydrolysis of 0.01M-methyl- and -benzyl-fructo-furanosides and -pyranosides and of sucrose in 0.00965M-hydrochloric acid at 20—60°. L. J. HEIDT and C. B. PURVES (J. Amer. Chem. Soc., 1938, 60, 1206—1210).—The hydrolysis was determined by means of the Shaffer-Hartmann-Somogyi alkaline Cu reagent. The unimol. rate coeffs.  $k$  at 20—60° have been determined, and are in accordance with:  $\log k = \log a - b/T$ . The activation energies  $E$  are:  $\alpha$ - and  $\beta$ -methyl- and  $\beta$ -benzyl-fructopyranoside 28.2, 29.9, 28.1 kg.-cal.,  $\alpha$ -methyl- and  $\alpha$ -benzyl-fructofuranoside 27.0, 25.2 kg.-cal., sucrose 25.7 kg.-cal. The consts.  $\log a$ ,  $b$ , and  $E$  increase when Me replaces  $\text{CH}_2\text{Ph}$ , when  $\alpha$ -replace  $\beta$ -isomerides, or when pyranosides replace furanosides. E. S. H.

Thermal decomposition of silver oxalate. J. Y. MACDONALD and R. SANDISON (Trans. Faraday Soc., 1938, 34, 589—594; cf. A., 1936, 940).—The change in electrical conductivity of  $\text{Ag}_2\text{C}_2\text{O}_4$  crystals during thermal decomp. lends support to the assumption that the nuclei are solid rather than laminar. The temp. coeff. is const. over the most strongly accelerating period and then rises to a higher val., indicating that the reaction is more complex than has hitherto been supposed. The time required for 50%

decomp. is greatly influenced by the environment of the crystals. It varies from <2 min. in PhCHO to 324 min. in paraffin wax. F. L. U.

Oxidation of metals. V. Oxidation of molten lead. L. L. BIRCUMSHAW and G. D. PRESTON (Phil. Mag., 1938, [vii], 25, 769—782).—The rate of formation of oxide films on molten Pb at 500°, 600°, and 700° is in accordance with the "parabolic" law in the early stages but later conforms to an equation of the type  $\log p = kt + c$ . X-Ray examination shows that the film at the Pb-oxide interface is red, tetragonal PbO, while at the  $\text{O}_2$ -oxide surface it is yellow orthorhombic PbO, probably present as a thin single-crystal film. T. H. G.

Velocity of dissolution of comminuted solids. VI. Velocity of dissolution of potassium ferricyanide and dichromate. VII. Indirect proof of applicability of the general equation for velocity of dissolution. W. JACEK (Rocz. Chem., 1938, 18, 18—23, 24—30; cf. A., 1937, I, 468).—VI. The rate of dissolution of  $\text{K}_3\text{Fe}(\text{CN})_6$  in  $\text{H}_2\text{O}$  at 17—19° is 5 times that of  $\text{K}_2\text{Cr}_2\text{O}_7$ .

VII. The val. of the temp. coeff. of dissolution of  $\text{K}_2\text{Cr}_2\text{O}_7$ , as calc. from Jacek's equations (A., 1929, 1375), is in good agreement with that reported by Jabczyński and Gutman (A., 1932, 345). R. T.

Velocity of dissolution of magnesium in aqueous ammonium chloride. II. E. BEKIER and S. GRAŻEWICZ (Rocz. Chem., 1938, 18, 9—15; cf. A., 1930, 866).—The val. of the velocity coeff.  $\propto 1/[\text{NH}_4\text{Cl}]$ , and is independent of the  $p_{\text{H}}$  over the range 5—8.6. R. T.

Production of detonation in explosives under the action of a thermal impulse.—See B., 1938, 735.

Inhibition of homogeneous organic decompositions. F. O. RICE and O. L. POLLY (J. Chem. Physics, 1938, 6, 273—279).—The inhibitory action of EtONO on the  $\text{O}_2$ -promoted chain decomp. of MeCHO is considerable at 300° and practically negligible at 500°. Addition of NO has also been investigated for the MeCHO decomp. near 500°; small amounts of NO (<0.5%) accelerate the decomp. rate. Inhibition by NO of org. decomp. is accounted for by a free radical mechanism, assuming that NO can both start and stop chains. Inhibition by propylene is also a free radical mechanism. W. R. A.

Catalytic influence of reaction products on the speed of decomposition of chromic acid in solutions of sulphur trioxide in water. H. C. S. SNETHLAGE (Rec. trav. chim., 1938, 57, 459—466; cf. A., 1936, 1073, 1470).—In 99.8%  $\text{H}_2\text{SO}_4$ , a reaction product retards the rate to an extent which depends on the ratio of  $\text{CrO}_3$  to reaction product concn.; at 50% decomp. in this solvent, reaction is pseudo-unimol. Results in solutions of >60%  $\text{H}_2\text{SO}_4$  are regarded as due to two simultaneous reactions, one pseudo-unimol., preponderating at 100%  $\text{H}_2\text{SO}_4$  and retarded by a reaction product, and the other bimol., preponderating at 80%  $\text{H}_2\text{SO}_4$  and accelerated by a reaction product. M. R.

**Highly polymerised compounds. CLXXXVIII. Kinetics of chain polymerisation. IV. Acceleration of polymerisation of styrene by benzoyl peroxide.** G. V. SCHULZ and E. HUSEMANN (*Z. physikal. Chem.*, 1938, **B**, 39, 246—274; cf. *A.*, 1937, **I**, 569).—Measurements in PhMe solution at 27—120° are recorded.  $Bz_2O_2$  accelerates the polymerisation and diminishes the chain length. The  $Bz_2O_2$  first forms an endothermic intermediate with styrene (heat of formation, —4500 g.-cal.), which is transformed unimolecularly into an active form. The latter is the starting point for the chain polymerisation.  $Bz_2O_2$  has no direct influence on the growth and breaking of chains. Chains are broken by collision of mols. in course of polymerisation. The time of growth of a single chain at 100° in a M solution is 10—100 sec. In the later stages of the polymerisation the reaction becomes pseudo-unimol., and the chain length remains approx. const. This is probably owing to the action of polystyrene in hindering chain breaking. H. J. E.

**Amorphous and crystallised oxide hydrates and oxides. XLI. Active and inactive bi- and ter-valent iron in homogeneous and heterogeneous systems.** A. KRAUSE [with Z. ALASZEWSKA and Z. JANKOWSKI] (*Ber.*, 1938, **71**, [B], 1033—1040).—The oxidation of  $HCO_2H$  is induced by  $Fe^{2+}$ , whereas  $Fe^{3+}$  is inactive; in the system  $AcOH-H_2O_2$  both types of ion are without influence if the medium is sufficiently acidic. In a heterogeneous system  $Fe^{III}$  when present as  $Fe(OH)_3$  is inferior to  $Fe^{II}$  since the action is truly catalytic. As redox catalyst, the active OH of which contain reactive H, amorphous  $Fe(OH)_3$  causes the oxidation of unlimited amounts of  $AcOH$  and  $HCO_2H$  by  $H_2O_2$ . For the same reasons hydrolysed solutions of  $Fe^{III}$  salts show a positive behaviour since their mols. are provided with OH groups (basic salts). Dissolved  $Fe^{III}$  is not identical with  $Fe^{3+}$  ions.  $Fe^{2+}$  induces the oxidation of  $H_3PO_3$  with  $H_2O_2$ .  $Fe(OH)_3$  is inactive in this case as a consequence of "blocking" of its active H, adsorption, or complex formation. Therefore  $H_3PO_3$  is a restricting agent and hinders the decomp. of  $H_2O_2$  and the oxidation of  $HCO_2H$  by  $H_2O_2$ .  $H_3PO_4$  also is markedly restrictive. In heterogeneous systems,  $Fe^{II}$ , as  $Fe_3O_4$ , has little or no action towards  $H_2O_2$  solution or to the system  $HCO_2H-H_2O_2$ . H. W.

**Catalysis in the exchanges of organic compounds with heavy oxygen water.** I. ROBERTS (*J. Chem. Physics*, 1938, **6**, 294).—The exchange of  $^{18}O$  from  $H_2^{18}O$  and certain substances in the absence of a catalyst and under conditions of acid and base catalysis has been investigated.  $MeOH$  and  $PhNO_2$  do not exchange at 25° even with a catalyst.  $KOAc$  without a catalyst showed no exchange.  $AcOH$  with 0.1N-HCl at 25° exchanges 2 O atoms in 40 days.  $BzOH$  at 100° in 4 hr. exchanges 2 O atoms with and without 0.1N-HCl. W. R. A.

**Phosphoric acid as catalyst in the ethylation of phenol.**—See *A.*, 1938, **II**, 273.

**Velocity coefficients of the reaction of oxidation of hydrogen at a cupric oxide catalyst.**

I. E. ADADUROV and B. R. MANOLENKO (*Ukrain. Chem. J.*, 1938, **13**, 139—150).—The velocity coeffs. increase with rise in temp. from 250° to 450°, and are at a max. for 1:1  $CuO$ -fireclay catalysts. The reaction is of the first order. R. T.

**Heterogeneous catalysis. III. Sorption of hydrogen by diamond.** E. STORFER (*Trans. Faraday Soc.*, 1938, **34**, 639—640).—Comments on papers by Barrer (*A.*, 1936, 1333) and the author (*ibid.*, 153). F. L. U.

**Catalytic exchange of gaseous oxygen isotopes. I. Exchange of oxygen atoms between oxygen and water vapour or carbon dioxide at the surface of platinum sponge and platinum [wire].** N. MORITA and T. TITANI (*Bull. Chem. Soc. Japan*, 1938, **13**, 357—370; cf. *A.*, 1937, **I**, 251).—Exchange of O isotopes between  $O_2$  and  $H_2O$  vapour occurs in Pt sponge above 550°, and on Pt wire above 760°. With  $CO_2$  and  $O_2$  exchange is rapid at 600° and still observable at 300—500°. From the coincidence of this temp. range with that of the "second" activated adsorption of  $O_2$  on Pt it is inferred that this process plays a decisive part in the exchange. The rate of exchange is nearly independent of the composition of the mixture over a wide range. F. L. U.

**Hydrogenation of simple sulphur compounds. I. Nickel subsulphide as a catalyst.** R. H. GRIFFITH and S. G. HILL. **II. Reactions of carbon disulphide and sulphur dioxide.** B. CRAWLEY and R. H. GRIFFITH (*J.C.S.*, 1938, 717—720, 720—723).—I. Reduced Ni at 350° with  $CS_2$  in  $N_2$  gives mainly  $NiS$ ,  $Ni_3S_2$  being prepared by treating  $NiS$  with  $H_2$  at 300° or by the action of coal gas on Ni at 250°. Adsorptions of  $CS_2$  and  $SO_2$  on  $NiS$  and  $Ni_3S_2$ , and of  $H_2$ ,  $MeSH$ , and  $COS$  on  $Ni_3S_2$ , have been measured and discussed.

II. With  $Ni_3S_2$  as catalyst at 100—250°, the hydrogenation of  $CS_2$  is initially of first order with respect to  $CS_2$ , but is retarded by higher  $[CS_2]$ . With increasing  $[CS_2]$ ,  $MeSH$  and  $H_2S$  production reaches a max. and then decreases; retardation is thus due to  $CS_2$  itself.  $MeSH$  is the primary hydrogenation product. With  $SO_2$ , reaction is also of first order, with slight retardation at higher concn. Results are discussed from the point of view of relative adsorptions. M. R.

**Influence of catalysts on decomposition of sodium sulphate.** S. D. SCHARGORODSKI (*Mem. Inst. Chem. Ukrain. Acad. Sci.*, 1938, **4**, 459—470).—The % decomp. of  $Na_2SO_4$  at 1200° is increased by metal oxides (0.0005—0.05%) in the order  $V_2O_5 > WO_3 > Cr_2O_3 > CeO_2 > Fe_2O_3$ . In presence of  $SiO_2$  the order is  $Fe_2O_3 > V_2O_5 > WO_3 > CeO_2 > Cr_2O_3$ , and the effect is > that calc. by adding the separate effects of  $SiO_2$  and metal oxide. F. L. U.

**Optical study of the behaviour of manganese catalyst in strongly acid solutions in presence of ozone.** L. N. KASCHTANOV and O. N. OLESCHTSCHUK (*J. Gen. Chem. Russ.*, 1938, **8**, 341—345).—The amount of  $Mn^{III}$  formed rises, and of  $MnO_2$  falls, with increasing  $[H_2SO_4]$ , when  $O_3$  is passed into acid aq.  $MnSO_4$ . Presence of  $PhOH$  favours formation of  $MnO_2$ . R. T.

**Action of inorganic additions as single and mixed catalysts in the water-gas process.** C. KRÖGER and G. MELHORN (Brennstoff-Chem., 1938, 19, 157—169).—Addition of various metallic oxides accelerated the reaction between graphite and steam at 600—800° in the following order of increasing activity: Al, Co, Mn, Tl, U, Fe, Ni, Cr, Cu. At 700° under the experimental conditions used, graphite + 8% of CuO effected a 22% conversion of steam into gas as compared with 6% conversion with graphite alone. Combinations of two oxides exhibited no greater catalytic activity than the single oxides. Alkali carbonates were highly active as catalysts, addition of  $K_2CO_3$  effecting a 32% decomp. of steam at 660°; the order of increasing activity of the carbonates was: Li, Cs, Rb, Na, K. Mixed catalysts containing alkali carbonates showed a greater activity than corresponded with the simple additive rule, the most effective being  $K_2CO_3$ -CuO and  $K_2CO_3$ - $Co_3O_4$ ; with the latter a 65% conversion was obtained at 650°. The mechanism of the action is discussed. With some catalysts, *e.g.*,  $ThO_2$  and  $Li_2CO_3$ , small quantities (0.3—2.1%) of unsaturated hydrocarbons were formed. With the alkali carbonates the water-gas equilibrium was attained in the gas at 570°. The Boudouard equilibrium ( $C + CO_2 \rightleftharpoons 2CO$ ) was approached with NiO,  $K_2CO_3$ - $Co_3O_4$ , and  $K_2CO_3$ -CuO, but was not reached in any of the experiments.

A. B. M.

**Catalytic combustion of gases on metals.** W. DAVIES (Engineering, 1938, 145, 587—589).—Comparison is made of the rates of heterogeneous combustion of various gas-air mixtures catalysed by a Pt wire of 0.001 in. diameter, the temp. of the wire being deduced from its resistance and the rate of combustion on its surface inferred by plotting the electrical input against the temp. For equally favourable conditions in the heterogeneous phase, relative rates for CO and  $H_2$  are governed by rates of diffusion to the wire as well as by relative heats of combustion. With increasing temp., combustion rates with CO and  $H_2$  reach max. and then decrease; the catalytic activity of the wire thus diminishes at high temp. A difference in initiation temp. does not necessarily involve preferential action in mixtures; a small amount of  $C_2H_2$  suppresses the combustion of  $H_2$  over a considerable temp. range. Au, Ag, Cu, and Fe wires are ineffective under similar conditions; Ni promotes combustion of  $C_2H_2$ .

M. R.

**Influence of contact poisons on the direction of heterogeneous catalytic reactions.** M. S. PLATONOV and V. I. TOMILOV (J. Gen. Chem. Russ., 1938, 8, 346—356).— $HCO_2H$  undergoes decomp. at a Ni catalyst according to the reactions (a)  $CO_2 + H_2 \leftarrow HCO_2H \rightarrow CO + H_2O$  (b). The velocity of reaction (a) rises steadily with rising temp. from 200° to 400°, whilst that of (b) is max. at 300°. Presence of  $H_2O$  favours (a), but depresses (b), to an extent  $\propto$  temp. at  $>250^\circ$ .  $H_2S$  inhibits both reactions, but (b) more than (a), and to a greater extent at 350° than at 250°.  $SO_2$  interferes with both reactions, as a result of the processes  $SO_2 + 3H_2 \rightarrow H_2S + 3H_2O$ ;  $2H_2S + SO_2 \rightarrow 2H_2O + 3S$ .  $H_2SO_4$  favours (b), but depresses (a),  $As_2O_3$  inhibits (b) at 250—350°, and (a)

at  $<300^\circ$ , but has little effect at  $>300^\circ$ , and  $As_2O_5$  favours (a) at 250—350°, and (b) at 250—300°, but not at  $>300^\circ$ . R. T.

**Hydrogenation of ethylene by iron synthetic ammonia catalysts.** R. C. HANSFORD and P. H. EMMETT (J. Amer. Chem. Soc., 1938, 60, 1185—1190).—The reaction rate with pure and promoted Fe catalysts has been determined between  $-40^\circ$  and  $-89^\circ$  and correlated with adsorption data and surface measurements. The rate of reaction with the promoted catalyst is considerably  $<$  with the unpromoted catalyst. The lower-temp. type of activated  $H_2$  adsorption plays the dominant part in the reaction,  $C_2H_4$  being physically adsorbed. E. S. H.

**[Catalytic] hydration of propylene.**—See B., 1938, 623.

**[Catalytic] synthesis of benzene from carbon monoxide and hydrogen.**—See B., 1938, 616.

**Catalysts for synthesis of esters from alcohols.**—See B., 1938, 624.

**[Catalytic] hydrogenation of groundnut oil.**—See B., 1938, 682.

**Rôle of catalysis in textile chemistry.**—See B., 1938, 631.

**Densities of  $D_2O$  and  $H_2O$ .** Electrolytic separation of oxygen isotopes. L. TRONSTAD and J. BRUN (Trans. Faraday Soc., 1938, 34, 766—773).—The prep. of 100%  $D_2O$  of normal O-isotopic ratio is described. Vals. of  $d_{20}^{20}$  have been redetermined as follows:  $D_2O$   $1.10726 \pm 0.00001$ ,  $H_2O$   $0.999980 \pm 0.000001$ . These vals. correspond with a mol. abundance ratio of  $D_2O$  in natural water of  $1 : 5960 \pm 300$ . The electrolytic separation factor for the O isotopes is  $\alpha = 1.036$ . The amount of  $^{18}O$  in commercial heavy water from Norsk Hydro-Elektrisk Kvaestof A./S. corresponds with 0.32%  $D_2^{18}O$ . F. L. U.

**Electrolysis of solutions of potassium and aluminium chlorides in nitrobenzene.** V. A. PLOTNIKOV and O. K. KUDRA (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, 4, 405—412).—Electrolysis of  $PhNO_2$  solutions of  $KCl + AlCl_3$  with Al anode and Cu cathode separated by a diaphragm leads at first to the deposition of pure K. In experiments of long duration the cathodic deposit contains in addition Al, Cl, and  $PhNO_2$ , and explodes when heated.

F. L. U.

**Cathode processes. New method for the study of solutions.** O. K. KUDRA (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, 4, 385—392).—The relation  $C = \alpha \sigma t^3$ , in which  $t$  is the time needed for the formation of a black powdery deposit on the cathode (cf. A., 1937, I, 369),  $C$  is the cation concn., and  $\sigma$  the c.d., is deduced. The formula is in agreement with the results of experiments with aq.  $ZnSO_4$ ,  $AgNO_3$ , and  $CuCl_2$ . The measurement of the time required for blackening of the cathode can be used to calculate the cation concn.

F. L. U.

**Electrolysis of solutions of protoactinium.** (MLLE.) H. EMMANUEL-ZAVIZZIANO and M. HAÏSSINSKY (Compt. rend., 1938, 206, 1102—1103; cf. A., 1937, I, 253).—Electrolysis of a solution containing Ti and Pa in presence of  $NH_4F$  ( $p_H$  approx. 6) gives a

deposit on a Pt cathode in which Pa is enriched. Increase in  $p_H$  and in c.d. favours the formation of white hydroxide and of basic salts on the cathode. Black, adherent deposits are obtained at  $p_H$  5.8 with vigorous agitation of the solution, and with a c.d. of 10 ma. per sq. cm. H. J. E.

**Electrochemical behaviour of rhodium. V. Higher stages of oxidation of rhodium. II.** G. GRUBE and H. AUTENRIETH (Z. Elektrochem., 1938, 44, 296—299; cf. A., 1937, I, 419).—Experiments on the electrolytic oxidation of  $Rh^{III}$  compounds have been continued. Complex amino- and cyano-salts cannot be further oxidised. Fluoride and fluosilicate solutions are partly oxidised to  $Rh^{IV}$ . Nitrate and especially basic nitrate solutions afford unstable solutions in which the valency of Rh is  $>4$ . Perchlorate solutions prepared in the cold and containing  $HClO_4$  in excess are oxidised almost completely to  $Rh^{VI}$ . The oxidation potential ( $Rh^{VI}$ — $Rh^{III}$ ) is approx. 1.46 v. in  $HNO_3$  solution and approx. 1.48 v. in  $HClO_4$  solution. *Chloropentammino-rhodium<sup>III</sup> perchlorate*,  $[Rh(NH_3)_5Cl](ClO_4)_2$ , is described. F. J. G.

**Electrolysis of fused salts. P.** DROSSBACH (Z. Elektrochem., 1938, 44, 288—291).—The increase of current efficiency resulting from the use of a diaphragm between the anode and cathode spaces is only partly to be accounted for by prevention of the reunion of metal and anode gas; another important factor is that the fused salt in the small cathode space becomes saturated with dissolved metal at an earlier stage in the electrolysis. A regulus of Cd was obtained after some hours in the electrolysis of fused  $CdCl_2$ , but addition of KCl enabled Cd to be obtained much sooner. In the electrolysis of fused  $SnCl_2$ ,  $SnCl_4$  is formed quantitatively at the anode. The factors controlling losses by recombination, and the importance of considering the equilibrium diagram for the system metal-salt, are discussed. (Cf. A., 1938, I, 85, 205). F. J. G.

**Electroplating of lead-antimony alloys.**—See B., 1938, 669.

**Theory of cathodic protection. R. B. MEARS and R. H. BROWN** (Trans. Electrochem. Soc., 1938, 74, Preprint 3, 35—43).—Experiments with Zn-Cu couples immersed in 20% aq. NaCl indicate that, in cases of purely electrochemical corrosion, cathodic protection is completely effective only when the local cathodes on the corroding specimen are polarised to the corresponding open-circuit electrode potential of the local anodes. J. W. C.

**Electrochemistry of corrosion. R. H. BROWN and R. B. MEARS** (Trans. Electrochem. Soc., 1938, 74, Preprint 2, 15—33).—A method for measuring the corrosion current of Al immersed in neutral NaCl is described. Comparison between the observed wt. loss determinations and the theoretical loss calc. from the current-time curves indicates that the corrosion of Al is purely electrochemical. Continuous measurements of the single electrode potential of Al can probably be utilised to detect the onset of film breakdown but do not necessarily afford any indication of the intensity of attack. J. W. C.

**Electrolysis of salts of heptonic acid alone or mixed with nitrates.**—See A., 1938, II, 258.

**Electrochemical "nitration." [Ester formation from ethylene.] V. ÖHMAN** (Svensk Kem. Tidskr., 1938, 50, 84—98).—Anodic oxidation of  $C_2H_4$  (I) with  $HNO_3$  or nitrates to give  $(CH_2O \cdot NO_2)_2$  (II) and  $([CH_2]_2O \cdot NO_2)_2$  (III) proceeds by way of free  $NO_3$ , necessitating a high anodic overvoltage. Current yields of 100% (II) + (III) (2:3) are obtained with  $Ca(NO_3)_2$  in slightly acid anhyd.  $COMe_2$  using high (I) concn., a high c.d., and bright Pt electrodes. Addition of  $H_2O$  reduces the yields by lowering the overvoltage, decreasing the stability of  $NO_3$  and the solubility of (I), and favouring the formation of  $O([CH_2]_2O \cdot NO_2)_2$ .  $(CH_2)_2O$  and  $NO_2 \cdot [CH_2]_2O \cdot NO_2$  have not been detected.

M. H. M. A.

**Reaction of hydrogen and deuterium with sputtered magnesium electrodes. O. MASAKI and Y. MORIMOTO** (J. Sci. Hiroshima Univ., 1938, 8, 113—120).—When a discharge is passed between Mg electrodes in a mixture of Ne with  $H_2$  and  $D_2$  (prepared by the action of K on 50%  $D_2O$ ), the ratios of the intensities of the  $D_\beta$ ,  $D_\gamma$ , and  $D_\delta$  lines to those of the corresponding H lines increase gradually. If Mg is first sputtered on the walls of the discharge tube in an atm. of Ne, and, after admission of the  $H_2$  and  $D_2$ , a discharge is passed between Al electrodes in the same vessel, similar changes in relative intensity are observed, but they occur more slowly. The results are attributed to the more rapid combination of  $H_2$  with Mg, owing to the greater collision frequency and smaller energy of dissociation of  $H_2$  mols.

J. W. S.

**"Clean-up" of inert gases in the electric discharge. II, III. H. ALTERTHUM and A. LOMPE** (Z. tech. Physik, 1938, 19, 113—116, 116—118; cf. A., 1937, I, 53).—II. The dependence of the rate of clean-up on the dimensions, material, and crystal structure of the electrodes, and on the cathode voltage drop, has been studied. Curves are given showing the variation of gas pressure, tube voltage, and rate of clean-up of Ne with time, for Th electrodes.

III. The rate of clean-up shows large variations with the nature of the electrode material, no relation being observed with other physical properties of the material, the cathode voltage-drop, or the degassing of the electrodes. The bottom of a hollow electrode plays no special part in the clean-up process.

A. J. E. W.

**Photo-oxidation of ammonium compounds in solution and soil.**—See B., 1938, 644.

**Theory of the blackening curve of photographic materials. II. J. E. DE LANGHE** (Physica, 1938, 5, 335—344).—The author's general theory (A., 1937, I, 39) is developed with regard to solarisation. Assuming that the developability of an emulsion grain is either suppressed or seriously reduced if there are more than a certain no. of activated nuclei per grain, statistical calculation gives for the ratio of the no. of developable grains to the average no. of nuclei per grain, a curve with a max. The author's earlier views on deviations from the law of reciprocity can easily be extended to the solarisation region.

Previous work on the no. of sensitive spots is corr. in the light of recent observations on the origin of the latent image. T. H. G.

**Theory of colour photography.**—See B., 1938, 733.

**Photolysis of the system uranyl sulphate-potassium iodide-water.** E. MONTIGNIE (Bull. Soc. chim., 1938, [v], 5, 564—566).—I is slowly formed by a dark reaction following hydrolysis of  $\text{UO}_2\text{SO}_4$ ; on illumination production of I is much more rapid, being slightly accelerated by a small, and slightly inhibited by a large, % of NaCl. Exposure to atm.  $\text{O}_2$  gives greatly increased reaction. M. R.

**Mercury-photosensitised decomposition of ethane.** E. W. R. STEACIE and N. W. F. PHILLIPS (J. Chem. Physics, 1938, 6, 179—187).—In Hg-photosensitised decomp. of  $\text{C}_2\text{H}_6$  the products of the reaction, analysed by low-temp. fractional distillation, are exclusively  $\text{CH}_4$ ,  $\text{C}_3\text{H}_8$ , and  $\text{C}_4\text{H}_{10}$ . The  $\text{H}_2$  and higher hydrocarbons reported previously arise from the secondary reactions involving decomp. of  $\text{C}_3\text{H}_8$  and  $\text{C}_4\text{H}_{10}$ . The mechanism put forward is:  $\text{C}_2\text{H}_6 + \text{Hg} (^2^3P_1) = 2\text{CH}_3 + \text{Hg} (1^1S_0)$ ;  $\text{CH}_3 + \text{C}_2\text{H}_6 = \text{CH}_4 + \text{C}_2\text{H}_5$ ;  $2\text{CH}_3 = \text{C}_2\text{H}_6$ ;  $2\text{C}_2\text{H}_5 = \text{C}_4\text{H}_{10}$ ;  $\text{CH}_3 + \text{C}_2\text{H}_5 = \text{C}_3\text{H}_8$ . W. R. A.

**Photopolymerisation of butadiene.** G. GEE (Trans. Faraday Soc., 1938, 34, 712—728).—The quantum yield in the Hg-sensitised photopolymerisation of butadiene is small (about 0.3) and not greatly affected by change of temp. or pressure in the range 15—100° and 2—70 mm. Reaction occurs both in the gas phase and on the surface. The proportion of the surface reaction increases with lowering of pressure. The kinetics of the reaction give a quant. and semi-quant. account of the gaseous and surface reactions, respectively. The reaction products are an insol. polymeride with smaller amounts of  $\text{H}_2$  and a cyclic dimeride. The proportion of the latter is greatest at low pressures. F. L. U.

**Photochemical reactions involving hydrogen sulphide and chloromethanes.** W. A. AVERY and G. S. FORBES (J. Amer. Chem. Soc., 1938, 60, 1005—1011).—Photolysis of  $\text{H}_2\text{S}$  solutions in  $\text{CH}_2\text{Cl}_2$ ,  $\text{CHCl}_3$ , or  $\text{CCl}_4$  by  $\lambda$  254 or 208 m $\mu$ . yields HCl in each case. The quantum yields based on HCl mols. formed per quantum absorbed by  $\text{H}_2\text{S}$  are in the order  $\text{CCl}_4 > \text{CHCl}_3 > \text{CH}_2\text{Cl}_2$ . The reaction products in  $\text{CCl}_4$  also contain S,  $\text{C}_2\text{Cl}_6$ , and  $\text{CCl}_3\text{SH}$ . The reaction mechanisms involved are discussed. E. S. H.

**Photolysis of aliphatic aldehydes. VI. Acetaldehyde.** F. E. BLACET and D. VOLMAN (J. Amer. Chem. Soc., 1938, 60, 1243—1247; cf. A., 1937, I, 627).—The volatile products of photolysis of MeCHO are  $\text{CH}_4$ ,  $\text{H}_2$ , and CO. The ratio  $\text{H}_2$ :CO decreases with increase of pressure, increases with increase in intensity or decrease in  $\lambda$ , and passes through a max. about 30°. A tentative chain mechanism of photolysis is proposed. The correlation between the volatile and the resinous products is discussed. E. S. H.

**Chemical reactions of organic compounds with X-ray-activated water.** H. FRICKE, E. J. HART, and H. P. SMITH (J. Chem. Physics, 1938, 6,

229—240).—Gas-free solutions of CO, alcohols, aldehydes, ketones, and acids of the aliphatic series were irradiated at different concns. and  $p_{\text{H}}$ , and the reactions studied by gas analysis and potentiometric acid analysis. Foreign org. matter was excluded by methods described. Oxidation and condensation reactions with evolution of  $\text{H}_2$  frequently occur.  $\text{CO}_2$  was liberated from certain acids; no CO,  $\text{O}_2$ , or hydrocarbons were evolved. The  $p_{\text{H}}$  affects both the rate and the nature of the reaction. The influences of concn. of substance and X-ray intensity are discussed. Reactions in systems containing two components are briefly described; reactions in the presence of  $\text{O}_2$  have also been investigated. The reactions in X-ray-activated  $\text{H}_2\text{O}$  are similar to, but more complicated than, reactions produced by  $\text{H}_2\text{O}$  activated with light inside the absorption band at 1900 Å. W. R. A.

**Photographic action of artificial radioelements.** C. GROVEN, J. GOVAERTS, and G. GUÉBEN (Nature, 1938, 141, 916—917).—A sheet of Ir activated by exposure to neutrons slowed down in paraffin blackened a photographic plate when placed upon it. When Al is placed between the activated Ir and the plate the intensity of blackening  $\propto$  the thickness of the Al. Radio-P has a similar effect on a photographic plate. L. S. T.

**Effect of electric fields on the decomposition of ammonia by  $\alpha$ -rays.** (MISS) C. SMITH and H. ESSEX (J. Chem. Physics, 1938, 6, 188—196).—The ion yields in the  $\alpha$ -ray decomp. of gaseous  $\text{NH}_3$  at 30° and 100° in the absence and presence of electric fields are recorded. The ion yields consist of two parts, one due to ion recombination, the other independent of ion recombination. The mechanisms of these two contributions and the extents to which they occur at the different temp. are discussed. W. R. A.

**Effect of deuterium substitution in colour.**—See A., 1938, II, 254.

**Oxidation of [copper-]beryllium bronzes.** H. N. TEREM (Bull. Soc. chim., 1938, [v], 5, 589—600).—A detailed account of results reported previously (B., 1937, 794, 1220). J. W. S.

**Magnetic study of the dehydration of crystalline cupric hydroxide.** (MLLE.) L. CHAUMETON (Compt. rend., 1938, 206, 1104—1106).—Measurements of the change in  $\chi$  in dehydrating pptd.  $\text{Cu}(\text{OH})_2$  at 110° and at 150—160° are recorded. There is no evidence for the formation of the intermediate  $3\text{CuO}, \text{Cu}(\text{OH})_2$ . H. J. E.

**Zinc peroxide.** G. COGNÉ (Compt. rend., 1938, 206, 1119—1120).—The compound  $\text{ZnO}_2 \cdot 0.5\text{H}_2\text{O}$  has been prepared by the action of 110—190-vol.  $\text{H}_2\text{O}_2$  on  $\text{Zn}(\text{OH})_2$ , or by the action of conc.  $\text{H}_2\text{O}_2$  on a solution of a Zn salt in excess of aq.  $\text{NH}_3$ . The peroxide is washed at 0° with  $\text{H}_2\text{O}_2$ ,  $\text{COMe}_2$ , and EtOH, and dried in vac. over  $\text{P}_2\text{O}_5$ . It is decomposed by  $\text{H}_2\text{O}$ , forming  $\text{H}_2\text{O}_2$ . The peroxide group in the mol. is constitutional, and is not present as an additive compound of  $\text{H}_2\text{O}_2$ . H. J. E.

**Zinc sulphate hydrates.** P. VALLET and M. BASSIÈRE (Bull. Soc. chim., 1938, [v], 5, 546—556).—Wt. decreases in samples of  $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$  for regularly



increasing temp. indicate that hexa-, tetra- and mono-hydrates are intermediate stages between heptahydrate and anhyd. salt. The necessary crit. conditions for isolation are discussed and the existence of the tetrahydrate is confirmed by X-ray analysis of the series. M. R.

**Hydrolysis of cadmium benzenesulphonate solutions.** (MLLE.) M. QUINTIN (Compt. rend., 1938, 206, 1215—1217).—The variation of the  $p_H$  with concn. ( $C$ ) for 0.001—0.082M-( $\text{PhSO}_3$ )<sub>2</sub>Cd has been investigated; the results are considered in relation to vals. of  $E_{\text{Cd}}$  obtained over the same concn. range (A., 1938, I, 254). For  $C > 0.01\text{M}$ ,  $[\text{Cd}^{++}] = K[\text{H}^+]^3$ , corresponding with formation of dissolved  $\text{Cd}(\text{OH})_2$  on hydrolysis; in more dil. solutions,  $[\text{Cd}^{++}] = K'[\text{H}^+]^2$ , indicating pptn. of the  $\text{Cd}(\text{OH})_2$ . A. J. E. W.

**Mixed precipitation of barium and strontium sulphates.** B. GOLDSCHMIDT (Compt. rend., 1938, 206, 1110—1113).—In the pptn. of sulphates by adding 0.2N-( $\text{NH}_4$ )<sub>2</sub> $\text{SO}_4$  to aq.  $\text{SrCl}_2$  containing 0.1% of  $\text{BaCl}_2$ , the unstable hydrated  $\text{SrSO}_4$  does not entrain  $\text{BaSO}_4$ . Only when it is transformed into the anhyd. form are mixed crystals obtained. With larger  $[\text{BaCl}_2]$  formation of the hydrate of  $\text{SrSO}_4$  is suppressed. The enrichment of Ba in the pptd. mixed sulphate is diminished by rise in temp. H. J. E.

**Gallium. III. Preparation and resolution of complex oxalato-compounds of gallium into optical isomerides.** P. NEOGI and N. K. DUTT (J. Indian Chem. Soc., 1938, 15, 83—86).—From solutions of  $\text{Ga}(\text{OH})_3$  in alkali H oxalate solutions the following complex oxalates may be crystallised:  $\text{M}_3[\text{Ga}(\text{C}_2\text{O}_4)_3] \cdot 3\text{H}_2\text{O}$  ( $\text{M} = \text{NH}_4, \text{K}, \text{Na}$ ). Double decomp. affords *l*-strychnine gallium trioxalate,  $[\text{Ga}(\text{C}_2\text{O}_4)_3](\text{HC}_{21}\text{H}_{22}\text{O}_2\text{N}_2)_3 \cdot 12\text{H}_2\text{O}$ ,  $[\alpha]_D^{25} - 15.5^\circ$ . Fractional extraction with  $\text{H}_2\text{O}$  leaves as residue the *l*-strychnine d-Ga salt,  $[\alpha]_D^{25} + 29^\circ$ , and from this the *K* and *NH*<sub>4</sub> d-salts may be obtained by double decomp. They have  $[\alpha]_D^{25} + 16.5^\circ$  and  $+15.5^\circ$ , respectively ( $\alpha$ -vals. refer to 1% solution in 50% EtOH). F. J. G.

(A) Preparation and analysis of a double thallium salt. (B) Preparation of univalent thallium hydroxide. P. V. GOGORISCHVILI and V. N. KULGINA (J. Gen. Chem. Russ., 1938, 8, 302—304, 305—307).—(A)  $\text{H}_2\text{O}_2$  is added to aq.  $\text{TlNO}_3$  or  $\text{Tl}_2\text{SO}_4$ , and  $\text{Cl}_2$  is passed at  $25^\circ$ ; Tl is pptd. quantitatively as  $\text{TlCl}_3 \cdot 3\text{TlCl}$ . Tl is best determined by pptn. with KI, washing the ppt. with 96% EtOH.

(B)  $\text{Tl}_2\text{O}_3$  and  $\text{H}_2\text{O}_2$  yield  $\text{TlOH}$  by the reaction  $\text{Tl}_2\text{O}_3 + 2\text{H}_2\text{O}_2 \rightarrow 2\text{TlOH} + \text{H}_2\text{O} + 2\text{O}_2$ . R. T.

**Concentration of  $^{15}\text{N}$  and  $^{34}\text{S}$ .** H. G. THODE, J. E. GORHAM, and H. C. UREY (J. Chem. Physics, 1938, 6, 296).—A 46-fold increase in the isotope ratio of  $^{15}\text{N}$  and  $^{14}\text{N}$  was brought about in approx. two weeks by the exchange reaction between  $\text{NH}_4\text{NO}_3$  solution and  $\text{NH}_3$  using a cascade apparatus described, and a sample of 14.8%  $^{15}\text{N}_2$  was obtained. Using the exchange reaction between  $\text{NaHSO}_4$  solution and  $\text{SO}_2$  in a similar apparatus led to a 3-fold rise within 7 days in the  $^{34}\text{S}$  and a 6.8% sample of  $^{34}\text{S}$  was procured. W. R. A.

**Phosphoric acids.**—See B., 1938, 643.

**Oxygen exchange reaction of glycine hydrochloride and water.** W. H. MEARS (J. Chem. Physics, 1938, 6, 295).— $\text{NH}_2\text{CH}_2\text{CO}_2\text{H} \cdot \text{HCl}$  exchanges its O with  $\text{H}_2^{18}\text{O}$  completely at  $100^\circ$  within 24 hr. at  $p_H$  1.9. Under identical conditions  $\text{NH}_2\text{CH}_2\text{CO}_2\text{H}$  does not exchange. W. R. A.

**Carbamide as an oxidising agent in presence of nitrous acid.** E. JUSTIN-MUELLER (Bull. Soc. chim., 1938, [v], 5, 262—263).—Nascent O is formed when  $\text{CO}(\text{NH}_2)_2$  and  $\text{HNO}_2$  react in presence of HCl. The oxidising reaction explains the formation of a red ppt. when HCl is added to nitroso- $\beta$ -naphthol in presence of  $\text{CO}(\text{NH}_2)_2$ . E. S. H.

**[Generation of] hydrogen sulphide.** V. T. JACKSON and F. C. SUHRER (J. Chem. Educ., 1938, 15, 179).—Equal amounts of S and rosin (20-mesh) are heated. 2 g. of the mixture give sufficient  $\text{H}_2\text{S}$  for most pptns. The C residue is easily removed. L. S. T.

**Action of magnesium on chromium trioxide.** E. MONTIGNIE (Bull. Soc. chim., 1938, [v], 5, 567—568).—In addition to MgO and Cr, binary compounds of Mg and Cr are formed when excess of Mg is used. Treatment of products with dil. acid suggests the compositions  $\text{Cr}_2\text{Mg}_2$ ,  $\text{Cr}_2\text{Mg}_3$ ,  $\text{Cr}_2\text{Mg}_6$ ,  $\text{Cr}_2\text{Mg}_8$ . M. R.

**Uranyl orthophosphates.** A. CHRÉTIEN and J. KRAFT (Bull. Soc. chim., 1938, [v], 5, 372—385).—Conductivity measurements and chemical analysis show that the addition of  $\text{UO}_2(\text{OAc})_2$  to  $\text{H}_3\text{PO}_4$  in aq. solution yields  $\text{UO}_2\text{HPO}_4$  (crystals of relatively high solubility) followed by  $(\text{UO}_2)_3(\text{PO}_4)_2$ , as a gelatinous ppt. of low solubility, the latter being formed directly by adding  $\text{H}_3\text{PO}_4$  to  $\text{UO}_2(\text{OAc})_2$ . Both phosphates are hydrated and sol. in  $\text{H}_3\text{PO}_4$  with formation of unstable complexes, the mono-acid salt being pptd. on dilution. Addition of  $\text{UO}_2(\text{OAc})_2$  to sol. mono-, di-, and tri-phosphates of K, Na,  $\text{NH}_4$ , or Ca gives hydrated ppts. of low solubility of type  $\text{UO}_2\text{MPO}_4$  (M univalent). M. R.

**Precipitation of perfectly white ferrous hydroxide in presence of potassium nitrate.** O. BAUDISCH (Ber., 1938, 71, [B], 992—995).—An apparatus is figured and described by which  $\text{Fe}(\text{HCO}_3)_2$  solution, obtained from Fe powder and  $\text{CO}_2$ , is pptd. by guanidine carbonate in presence of  $\text{KNO}_3$ , free from  $\text{KNO}_2$ . The experiment is suitable for lecture purposes. H. W.

**Action of nitric acid on iron and on iron carbide.** A. TRAVERS and R. DRÉBOLD (Bull. Soc. chim., 1938, [v], 5, 690—693).—In absence of  $\text{O}_2$  the action of dil.  $\text{HNO}_3$  ( $d$  1.2) on Fe at  $<30^\circ$  yields only  $\text{Fe}(\text{NO}_3)_2$ . Probably FeO and  $\text{HNO}_2$  are formed initially, the former dissolving in the  $\text{HNO}_3$  and the latter decomp. to form NO,  $\text{HNO}_3$ , and  $\text{H}_2\text{O}$ . As dissolution occurs in  $\text{HNO}_3$  previously treated with  $\text{CO}(\text{NH}_2)_2$ , N oxides are not necessary to start the reaction. In contact with air  $\text{Fe}^{+++}$  is formed. In a closed vessel the reaction ceases when all the  $\text{O}_2$  has been removed, owing to the equilibrium  $2\text{NO} + \text{HNO}_3 + \text{H}_2\text{O} \rightleftharpoons 3\text{HNO}_2$ . In dil. ( $<10\%$ )  $\text{HNO}_3$ , the electrode potential ( $V$ ) of Fe with respect to the

H electrode is  $-0.35$  to  $-0.4$  v., and is stable, but in 32.4%  $\text{HNO}_3$   $V$  is no longer stable and undergoes oscillations about  $+0.05$  v., which occur simultaneously with the alternate formation and dispersion of a brown layer, probably of  $\text{NO}_2\text{Fe}(\text{NO}_3)_2$ , on the metal. With 36.6%  $\text{HNO}_3$  oscillation occurs between  $+0.28$  and  $+0.32$  v.; the amplitude increases and frequency decreases with increasing  $[\text{HNO}_3]$ , until with 65.8% acid  $V$  becomes stable again at  $+1.32$  v., and the metal remains bright.  $V$  decreases with increasing temp. The action of  $\text{HNO}_3$  on  $\text{Fe}_3\text{C}$  is slow in the cold and is accompanied by the production of a brown colour, probably due to  $\text{NO}_2$ -derivatives of the olefines formed. These could not be detected by extraction with org. solvents, probably owing to their solubility in  $\text{H}_2\text{O}$ . J. W. S.

**Action of iron filings and of iron carbide on iodine and water.** A. TRAVERS and R. DIÉBOLD (Bull. Soc. chim., 1938, [v], 5, 693—694).—Action of excess of I and  $\text{H}_2\text{O}$  on Fe filings yields sol.  $\text{FeI}_6$  and a ppt. of  $\text{Fe}(\text{IO}_3)_2$ . This provides direct proof of the existence of an equilibrium  $\text{I}_2 + \text{H}_2\text{O} \rightleftharpoons \text{HI} + \text{HOI}$ . When  $\text{Fe}_3\text{C}$  is agitated with excess of I in cold  $\text{H}_2\text{O}$  the attack is similar to that on pure Fe, and active C is pptd., but the action is too slow for use in the analysis of steel. Action of  $\text{CuCl}_2 \cdot 2\text{KCl}$  at  $70^\circ$  also causes liberation of C, but the action is rapid and complete. The results indicate that  $\text{Fe}_3\text{C}$  is unstable at low temp. (cf. A., 1936, 1332). J. W. S.

**Preparation and analysis of solutions of a tervalent osmium bromide.** W. R. CROWELL, R. K. BRINTON, and R. F. EVENSON (J. Amer. Chem. Soc., 1938, 60, 1105—1107).—Solutions of  $\text{K}_3\text{OsBr}_6$ , free from  $\text{Os}^{\text{IV}}$ , can be obtained by electro-reduction of  $\text{K}_2\text{OsBr}_6$  in aq. HBr, using a Pt cathode. Methods of analysis of the solutions are described. E. S. H.

**cis-Tetrammine of quadrivalent platinum.** I. I. TSCHERNIAEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, 18, 581—582).—When Cleve's triammine,  $[\text{Pt}(\text{NH}_3)_3\text{Cl}_3]\text{Cl} \cdot \text{H}_2\text{O}$ , is treated with a large excess of  $\text{NH}_3$  the *cis*-dichlorotetramminochloride,  $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}_2$ , is obtained. It differs from the *trans*-compound (Gro's chloride) in being much more sol. (7.15% at  $20^\circ$  and 7.75% at  $30^\circ$ ) and in its reactions. It is reduced only with difficulty (Zn and HCl) and then affords  $[\text{Pt}(\text{NH}_3)_3\text{Cl}]\text{Cl}$  (thus confirming the *cis*-configuration), whilst with alkalis a base, for which three formulæ are possible, viz.,  $[\text{Pt}(\text{NH}_3)_3(\text{NH}_2)\text{Cl}_2]\text{OH} \cdot \text{H}_2\text{O}$ ,  $[\text{Pt}(\text{NH}_3)_2(\text{NH}_2)_2\text{Cl}_2] \cdot 2\text{H}_2\text{O}$ , or  $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2](\text{OH})_2$ , is pptd. The *cis*-dichlorotetrammino-sulphate and -nitrate have also been obtained. F. J. G.

**Cleve's triammine.** I. I. TSCHERNIAEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, 18, 579—580).—The triammine,  $[\text{Pt}(\text{NH}_3)_3\text{Cl}_3]\text{Cl} \cdot \text{H}_2\text{O}$ , is best prepared by treating Peyrone's salt, *cis*- $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ , with 1 mol. of  $\text{NH}_3$ , oxidising with  $\text{Cl}_2$ , and pptg. with HCl. Its solubility at  $20^\circ$  is 5.64%. With KOH it affords the amidotrichlorodiammine  $[\text{Pt}(\text{NH}_3)_2(\text{NH}_2)\text{Cl}_3]$ , and with  $\text{NaNO}_2$  a nitrodichlorotriammine,  $[\text{Pt}(\text{NH}_3)_3(\text{NO}_2)\text{Cl}_2]\text{Cl} \cdot \text{H}_2\text{O}$ , which is an isomeride of the known compound and reacts differently with alkalis, affording an amidonitrodichlorodiammine,

$[\text{Pt}(\text{NH}_3)_2(\text{NH}_2)(\text{NO}_2)\text{Cl}_2]$ . The configurations of these compounds are discussed. The trichlorotriammino-sulphate and -nitrate, and the tribromotriamminobromide,  $[\text{Pt}(\text{NH}_3)_3\text{Br}_3]\text{Br} \cdot \text{H}_2\text{O}$ , have also been obtained. F. J. G.

**X-Ray spectrum analysis of elements.** I. B. BOROVSKI (Zavod. Lab., 1938, 7, 184—189).—Known methods are discussed. R. T.

**Organic precipitants in quantitative analysis.** W. PRODINGER (Chem.-Ztg., 1938, 62, 373—376).—A review.

**Coulometric analysis as a precision method.** I—III. L. SZEBELLÉDY and Z. SOMOGYI (Z. anal. Chem., 1938, 112, 313—323, 323—331, 332—336).—I. A technique of electrolytic analysis is developed which permits accurate standardisation of solutions in cases where the material to be determined shows a definite colour change when completely decomposed, or it reacts with another material to give a product which shows such a change. The quantity of current required to produce this change is measured with a Ag coulometer.

II. HCl is determined by electrolysis, using a Ag anode and a rotating Pt cathode, which acts as a stirrer. Excess of KCl is added to the solution. The end-point is determined with an acid-base indicator, preferably changing at  $p_{\text{H}} < 7$ , e.g., bromocresol-green, added shortly before the end-point is reached. Comparison is made with the colour in a blank specimen containing the same amount of KCl and indicator, to which weighed amounts of the test solution are added to yield the intermediate colour. Electrolysis may also be carried out with a Pt anode if PhOH and KBr are added to react with the  $\text{Cl}_2$  formed and prevent reproduction of HCl and HOCl.

III. For standardisation of  $\text{H}_2\text{SO}_4$ , a weighed quantity is added to  $\text{H}_2\text{O}$  containing  $\text{K}_2\text{SO}_4$  and KCl, and electrolysis is carried out between Pt and Ag electrodes in the same way as for HCl. J. W. S.

**Quinhydrone electrode.** Application in determining the hydrogen-ion concentration of liquids and semiplastic solids. G. P. SANDERS (Ind. Eng. Chem. [Anal.], 1938, 10, 274—275).—Modifications of the electrode, sample vessel, and calomel half-cell are described. A Au-plated Pt wire is substituted for the usual glass-sleeve electrode, and a sealed-in Pt wire for a stopcock in the calomel half-cell. Applications of the new electrode and portable half-cell to the determination of  $p_{\text{H}}$  of liquids and semi-plastic materials is described. L. S. T.

**Use of adsorption indicator in acidimetry and alkalimetry.** S. N. ROY (J. Indian Chem. Soc., 1938, 15, 165).—Fluorescein (or eosin) +  $\text{Bi}^{\text{III}}$  can be used as an indicator in the titration of NaOH or  $\text{Na}_2\text{CO}_3$  with  $\text{HNO}_3$ . E. S. H.

**Determination of equivalent acidity and basicity of fertilisers. Mixed indicators.**—See B., 1938, 703.

**Continuous determination of small amounts of water.** K. FISCHBECK and E. ECKERT (Z. anal. Chem., 1938, 112, 305—313).—The  $\text{H}_2\text{O}$  formed by a reaction is swept by a current of  $\text{H}_2$  over heated

anhyd.  $\text{AlCl}_3$ . The HCl produced is absorbed in  $\text{Na}_2\text{CO}_3$ , the change in titre of which is determined. When PhOH, BzOH, C<sub>6</sub>H<sub>5</sub>OH, and sucrose are heated and the vapours produced are passed over heated  $\text{AlCl}_3$ , the amounts of HCl produced correspond with  $\frac{1}{2}$ ,  $\frac{1}{3}$ ,  $\frac{1}{4}$ , and  $\frac{2}{3}$  of the theoretical amounts, respectively. These results are attributed to the formation of org. Al compounds and variation in the temp. of reaction of  $\text{AlCl}_3$  with org. compounds. Apparatus for the determination is described in detail. J. W. S.

Water analysis.—See B., 1938, 737.

Determination of chlorine in water.—See B., 1938, 737.

Determination of free iodine in iodine ointment.—See B., 1938, 728.

Determination of oxygen in water in presence of nitrites.—See B., 1938, 737.

Reaction of sulphur. L. VAN ITALIE (J. Pharm. Chim., 1938, [viii], 27, 465—467).—S with NaOH and  $\text{C}_5\text{H}_5\text{N}$  or  $\text{COMe}_2$  gives a blue colour, passing to green. Similarly  $(\text{NH}_4)_2\text{S}$  with  $\text{C}_5\text{H}_5\text{N}$  gives a green colour, and with  $\text{COMe}_2$  a yellow-green. J. D. R.

Determination of sulphur in steels and iron alloys by combustion in oxygen.—See B., 1938, 662.

Determination of reducing acids of sulphur. E. CHERBULIEZ and A. HERZENSTEIN (Arch. Sci. phys. nat., 1938, [v], 20, Suppl., 23—25; cf. A., 1935, 184).— $\text{H}_2\text{S}_2\text{O}_3$  and  $\text{H}_2\text{SO}_3$  in mineral waters may be determined by titration with I in a solution buffered to  $p_{\text{H}}$  7 after elimination of  $\text{H}_2\text{S}$  and  $\text{H}_2\text{S}_2\text{O}_4$  by the addition of neutral  $\text{IO}_3^-$  and  $\text{I}^-$ . M. R.

Bromo-iodometric determination of ammonia and its application to the determination of nitrogen after destruction by Kjeldahl's [method]. T. A. G. HAANAPPEL (Pharm. Weekblad, 1938, 75, 570—574).— $\text{NH}_3$  is oxidised quantitatively to  $\text{N}_2$  by 0.1N-NaOBr (prepared from 0.2N-KBrO<sub>3</sub>, 4N-HBr, and 4N-NaOH) in presence of a buffer containing 4 g. of borax and 3 g. of  $\text{H}_3\text{BO}_3$  per 100 c.c. (4 c.c. to 5 c.c. of 0.1N-NaOBr). After 15 min. KI and HCl are added and excess of Br is titrated with 0.1N- $\text{Na}_2\text{S}_2\text{O}_3$ . The conc.  $\text{H}_2\text{SO}_4$  solution from the Kjeldahl determination can be neutralised with NaOH and used directly provided no Hg or Cu has been used as catalyst.  $\text{H}_2\text{O}_2$  is recommended for decolorising the solution. S. C.

Use of Kjeldahl method in examination of nitrogen fixation of germinating leguminous seeds.—See A., 1938, III, 627.

Method of adding alkali in Kjeldahl distillation. L. A. YNALVEZ (Philippine Agric., 1938, 25, 823—826).—Alkali is added slowly from a funnel via an adjustable screw-clipped tube to the steam inlet tube of the distillation flask, air having been previously swept out of the apparatus by steaming for 5 min. Large excess of alkali is thus avoided, frothing is minimised, and accuracy improved. A. G. P.

Determination of phosphate [in waters and soil extracts] by photo-electric colorimetry.

W. J. DYER and C. L. WRENSHALL (Canad. J. Res., 1938, 16, B, 97—108).—Photo-electric colorimeter technique has been applied to the ceruleomolybdate reaction. The procedure, which serves to differentiate  $\text{PO}_4$  from other forms of combined P, can be carried out in presence of extraneous colour or soil org. matter. E. S. H.

Colorimetric determination of phosphate in turbid water and in water containing silicic acid.—See B., 1938, 737.

Iodometric determination of arsenates and arsenites in presence of chlorates. A. B. DRANOVSKI (Zavod. Lab., 1938, 7, 108—109).—1 g. of  $\text{NaHCO}_3$  is added to the neutral solution containing  $\text{As}^{\text{III}}$ ,  $\text{As}^{\text{V}}$ , and  $\text{ClO}_3^-$ , and  $\text{As}^{\text{III}}$  is titrated with 0.1N-I in KI. 2 g. of KI and 10 ml. of conc. HCl are added, and I liberated by  $\text{ClO}_3^-$  is titrated. 50 ml. of conc. HCl are added, and the solution is titrated with 0.1N- $\text{Na}_2\text{S}_2\text{O}_3$  (total As). R. T.

Determination of free arsenic trioxide in calcium arsenite [insecticides].—See B., 1938, 709.

Determination of boron by a modified flame test. H. C. WEBER and R. D. JACOBSON (Ind. Eng. Chem. [Anal.], 1938, 10, 273).—With the apparatus described the intensity of colour, due to  $\text{Me}_3\text{BO}_3$ , in the flame diminishes quickly when the B content of the sample reaches 0.03 mg., but the total time of duration of colour is practically a linear function of the B content up to approx. 0.1 mg. Glasses etc. are first fused with  $\text{K}_2\text{CO}_3$ , extracted with  $\text{H}_2\text{O}$ , and an aliquot portion is evaporated almost to dryness before applying the method. Even with glasses containing <1%  $\text{B}_2\text{O}_3$  an accuracy of 10% can be obtained. L. S. T.

Colorimetric determination of silica in a lime mortar.—See B., 1938, 655.

Turbidimetric determination of carbon dioxide in condensed water.—See B., 1938, 710.

Alkalimetric determination of the metallic components of alkali metal salts and of organic compounds and mixtures containing alkali, halogen, sulphur, and arsenic. E. SCHULEK and L. SZLATINAY (Z. anal. Chem., 1938, 112, 336—342).—The materials containing alkali metal are heated with  $\text{H}_3\text{BO}_3$  to eliminate other acids, and the borates formed are dissolved and titrated with HCl. Halide salts are preferably moistened with  $\text{HNO}_3$  before heating, to minimise loss by evaporation, whilst in presence of  $\text{AsO}_3^{\text{III}}$  and  $\text{SO}_4^{\text{II}}$  the salt is mixed with  $\text{H}_3\text{BO}_3$  and glucose to cause reduction to  $\text{As}^{\text{III}}$  and  $\text{S}^{\text{II}}$ , respectively. J. W. S.

Application of the Berens-Lassen reaction to the rapid determination of potassium. V. M. TICHOMIROV and S. N. CHOLMOGOROV (Zavod. Lab., 1938, 7, 33—36).—K is determined as  $\text{K}_2\text{CuPb}(\text{NO}_2)_6$ , which is pptd. and washed at 7—10°, and weighed; the results differ by 0.2—0.4% from those given by the perchlorate method. The method is not applicable to chlorides containing <5% of KCl, owing to pptn. of  $\text{PbCl}_2$  from the solutions. R. T.

**Determination of potassium in fertilisers.**—See B., 1938, 704.

**Colorimetric determination of caesium.** E. S. BURKSER and R. V. FELDMAN (*Zavod. Lab.*, 1938, 7, 166—168).—0.1 ml. of solution, containing 0.13—0.8 mg. Cs, is added to 2 ml. of HCl, followed by 0.2 ml. of a Na silicomolybdate reagent, and the mixture is centrifuged after 2 min. 1 ml. of 5% SnCl<sub>2</sub> is added to the washed residue suspended in 30 ml. of H<sub>2</sub>O with 2 ml. of HCl, and the blue colour developing is compared with that given by a standard solution. Pb interferes, but not Al, K, Na, Li, Fe, Mg, or SO<sub>4</sub>.  
R. T.

**Separation of calcium as sulphate by precipitation in concentrated methyl alcohol solution. Application to the analysis of magnesite and technical magnesium oxide.** E. R. CALEY and P. J. ELVING (*Ind. Eng. Chem. [Anal.]*, 1938, 10, 264—269).—The Ca is pptd. from Cl<sup>-</sup>, NO<sub>3</sub><sup>-</sup>, or ClO<sub>4</sub><sup>-</sup> solution that is free from NH<sub>4</sub><sup>+</sup>, Ba<sup>++</sup>, Sr<sup>++</sup>, and Pb<sup>++</sup>, but may contain, in addition to Ca<sup>++</sup> and Mg<sup>++</sup>, small amounts of Al, Fe, and Mn, and very small amounts of the alkalis, by the addition of 99% MeOH in presence of H<sub>2</sub>SO<sub>4</sub> until the solution contains 90 vol.-% of MeOH. The order of addition of reagents does not affect completeness of pptn. but influences filtering and washing. The pptd. Ca is weighed as CaSO<sub>4</sub> after ignition at 400—450°. The time required for complete pptn. increases with [Mg]. The amount of Ca must be <200 mg., and the ratio of Mg to Ca must be >200 to 1. When the amount of Al or Fe is high pptn. is incomplete. The Fe can be removed by evaporation almost to dryness with HClO<sub>4</sub> when the Fe(ClO<sub>4</sub>)<sub>3</sub> is decomposed into oxide; the Ca(ClO<sub>4</sub>)<sub>2</sub> can then be extracted from the residue. The CaSO<sub>4</sub> method can be applied to magnesite and dolomite, but less satisfactorily to limestone. The sample should contain >3% of Fe, >0.5% of Na + K, and <0.5% of Ca. MeOH is preferable to EtOH, AcOH, or COMe<sub>2</sub> for pptg. CaSO<sub>4</sub>. Data showing the effect of various factors are recorded.  
L. S. T.

**Thermal behaviour of some compounds important in analytical practice. I. Behaviour of BaCrO<sub>4</sub> and MgNH<sub>4</sub>PO<sub>4</sub>.** B. SAGORTSCHEV (*Z. physikal. Chem.*, 1938, 182, 31—41).—It has been shown by Hahn's emanation method that all irregularities in the emanation power-temp. curves of BaCrO<sub>4</sub> are attributable to impurity, and that pure BaCrO<sub>4</sub> is not decomposed after gradual heating to 1000°. Hence in gravimetric determination of Ba<sup>++</sup> as BaCrO<sub>4</sub> the ppt. can be dried at high temp. No mol. change could be detected at <1000°. Emanation power-temp. curves indicate that MgNH<sub>4</sub>PO<sub>4</sub>·6H<sub>2</sub>O when heated passes successively into MgNH<sub>4</sub>PO<sub>4</sub>, MgHPO<sub>4</sub>, and Mg<sub>2</sub>P<sub>2</sub>O<sub>7</sub>.  
J. W. S.

**Method for determining the radium content of rocks by direct α-ray counting.** J. H. J. POOLE (*Sci. Proc. Roy. Dublin Soc.*, 1938, 21, 595—608).—The rock is de-emanated by one of the usual methods and the Rn removed to an ionisation chamber, the inner electrode of which is connected to a Wynn-Williams type amplifier. The α-ray emission is measured by means of a recording oscillograph or a

thyatron counter and compared with that produced by a standard quantity of Rn in the chamber. Full details of this apparatus, of a new fusion furnace, and of the method of working are given.  
T. H. G.

**Introduction of the Schlagdenhauffen (magnesium hypiodite) reaction for the detection of magnesium into the usual analytical procedure.** P. REMY-GENNETÉ (*Bull. Soc. chim.*, 1938, [v], 5, 666—675).—After removal of heavy metals, NH<sub>3</sub> is eliminated with CH<sub>2</sub>O or by boiling almost to dryness with repeated quantities of saturated aq. Ca(OH)<sub>2</sub> until the solution remains alkaline. After cooling, a few drops of freshly prepared hypiodite reagent [0.1N-I in a min. of KI and treated with Ca(OH)<sub>2</sub> until almost decolorised] are added, the appearance of a brownish-maroon ppt. indicating the presence of Mg. The theory of the reaction is discussed.  
J. W. S.

**Adsorption of diazo-compounds on cadmium and magnesium hydroxides. IV. Nitrodiazo-amino-compounds for the detection of magnesium.** F. P. DWYER (*J. Proc. Austral. Chem. Inst.*, 1938, 5, 149—154).—4-Nitrobenzene-4'-nitro-(1:1')-diazoaminonaphthalene gives a brilliantly coloured lake with Mg(OH)<sub>2</sub> which can be used to detect 0.1 μg. of Mg per c.c.  
P. G. M.

**Quantitative spectrochemical analysis. Chemical and metallurgical applications.**—See B., 1938, 665.

**Quantitative spectrographic analysis of magnesium alloys for manganese and silicon.**—See B., 1938, 668.

**Determination of magnesia in fertilisers.**—See B., 1938, 704.

**Volumetric determination of cadmium in presence of other cations.** M. E. ZIMBLER (*Mem. Inst. Chem. Ukrain. Acad. Sci.*, 1938, 4, 471—479).—Small amounts of Cd in presence of Zn, Cu, Ni, Mg, and Al can be determined to within 0.3% by removing Al with aq. NH<sub>3</sub>, and pptg. CdCO<sub>3</sub> with Na<sub>2</sub>CO<sub>3</sub> or NaHCO<sub>3</sub> in presence of warm NH<sub>4</sub>Cl. The ppt. is washed, and dissolved in a measured excess of standard acid.  
F. L. U.

**Colorimetric determination of lead in maple syrup.**—See B., 1938, 712.

**Determination of copper in biological material.**—See A., 1938, III, 633.

**Determination of small amounts of mercury.** N. S. KRUPENIO (*Zavod. Lab.*, 1938, 7, 161—162).—10 ml. of solution are boiled under reflux for 2 hr. with 20 ml. of aqua regia, Hg<sup>II</sup> is pptd. by adding excess of NH<sub>4</sub>[Cr(CNS)<sub>4</sub>(NH<sub>3</sub>)<sub>2</sub>], the washed ppt. is dried and ignited, and the Hg content of the solution is derived from the wt. of the residual Cr<sub>2</sub>O<sub>3</sub>.  
R. T.

**Methylene-blue as a reagent for cerium.** R. A. REED (*Analyst*, 1938, 63, 338—339; cf. A., 1936, 43).—The solution to be tested is oxidised with H<sub>2</sub>O<sub>2</sub> in acid solution, methylene-blue is added, and the solution made distinctly alkaline with NaOH. A green colour in place of the usual blue indicates the presence of Ce, 1 p.p.m. of which may be detected in

presence of a large no. of metals, only Hg, Pb, Bi, and  $\text{MoO}_4$  interfering. E. C. S.

**Application of fluorescence to quantitative analysis.** A. OKAC (Coll. Czech. Chem. Comm., 1938, 10, 177—181).—Al may be determined by the fluorescence of the Al salt of morin under standard conditions of solvent and concn. Alkali fluorides may be titrated in presence of NaCl with an alcoholic  $\text{AlCl}_3$  solution containing morin, the end-point being characterised by fluorescence occurring when  $\text{Al}^{+++}$  ceases to be removed as the non-fluorescent  $\text{AlF}_6'''$ . M. R.

**Semi-quantitative drop reactions by limitation of the reaction surface.** H. YAGODA (Mikrochem., 1938, 24, 117—130; cf. A., 1937, I, 199).—Details are given of a technique in which drop reactions are carried out in filter-paper in an area of definite cross-section enclosed in a paraffin ring. The paper is impregnated with reagent and the test drop eventually drawn through the confined area. The coloured spot is compared in transmitted light with suitable standards. The procedure is suitable for 0.1—250  $\mu\text{g}$ ., and an accuracy of 5 to 10% can be expected. The tests used are the alizarin reaction for Al, the Gutzeit test for As, the cinchonine test for Bi, the benzimidazole test for Co, the benzoinoxime, Zn xanthate, or  $(\text{NET}_2 \cdot \text{CS}_2)_2\text{Zn}$  tests for Cu, the Prussian-blue test for Fe, and the  $\text{K}_2\text{CrO}_4$  or rhodanine test for Ag. Alcoholic solutions, preferably of MeOH, of the reagents are the most suitable for this method. L. S. T.

**Formaldoxime as a colour reagent for metals. Determination of manganese in water and iron.** G. H. WAGENAAR (Pharm. Weekblad, 1938, 75, 641—648).—Definite colour reactions are obtained with formaldoxime and the following, the limiting concn. in mg. per l. being given in parentheses: Cu (0.3), Co (1), Ni (0.3), Mn (0.08),  $\text{Fe}^{+++}$  (0.5),  $\text{Fe}^{++}$  (1). In the determination of Mn in  $\text{H}_2\text{O}$ , 10 c.c. are boiled for 5 min. with 2 drops of 4N-HCl and 1 drop of 30%  $\text{H}_2\text{O}_2$ . 1 g. of NaOAc [or ZnO or  $(\text{CH}_2)_6\text{N}_4$ ] and a drop of  $\text{FeCl}_3$  solution are added, the solution is filtered, and the ppt. washed with acetate solution. Mn is determined colorimetrically in the filtrate (standard, 10 mg. per l.). A similar method is used for the determination of Mn in Fe after the latter has been dissolved in dil.  $\text{H}_2\text{SO}_4$  and  $\text{HNO}_3$  and the Fe pptd. as basic acetate. Similar methods can be used for the determination of Ni and to a limited extent of Co and Cu, but not Fe. Using  $\text{MnSO}_4$  and  $\text{NH}_2\text{OH} \cdot \text{HCl}$ ,  $\text{CH}_2\text{O}$  can be detected colorimetrically at a dilution of  $>1:1000$ . S. C.

**Determination of ferric salts by reduction with cuprous oxide.** P. FLEURY and M. HARLAY (J. Pharm. Chim., 1938, [viii], 27, 513—522).— $\text{Fe}^{\text{III}}$  salts are accurately determined by reducing in dil.  $\text{H}_3\text{PO}_4$  with excess of  $\text{Cu}_2\text{O}$  (complete reduction in 2 min.), filtering, and titrating with  $\text{KMnO}_4$ . A  $\text{H}_2\text{SO}_4$  medium gives high results, but small quantities of  $\text{H}_2\text{SO}_4$  or HCl do not affect the reaction, the HCl being pptd. as  $\text{CuCl}$ . A. Li.

**Volumetric determination of iron in aluminium ores.**—See B., 1938, 665.

**Colorimetric micro-determination of iron.**—See A., 1938, III, 633.

**Spectroscopic analysis of steels.**—See B., 1938, 662.

**Precipitation of crystalline nickel and cobalt sulphides in presence of pyridine.** E. A. OSTROUMOV (Zavod. Lab., 1938, 7, 20—23).—30 ml. of neutral 20% aq.  $\text{C}_5\text{H}_5\text{N}$  are added to 75 ml. of a hot Co or Ni salt solution, which is then saturated with  $\text{H}_2\text{S}$ ; the sulphides are pptd. in a coarsely cryst., readily filterable form. R. T.

**Determination of chromium in aluminium alloy.**—See B., 1938, 668.

**Analysis of chromite.**—See B., 1938, 645.

**Effect of phosphate on the determination of tungsten.** S. G. SIMPSON, W. C. SCHUMB, and M. A. SIEMINSKI (Ind. Eng. Chem. [Anal.], 1938, 10, 243—245).—The acid pptn. method ( $\text{HCl} + \text{HNO}_3$  or  $\text{HClO}_4$  alone) is untrustworthy in presence of even small amounts (0.4 mg.) of  $\text{P}_2\text{O}_5$ . Low results are obtained, and the error increases with increasing amounts of  $\text{P}_2\text{O}_5$ . It is attributed to the formation of paratungstate. In absence of  $\text{PO}_4'''$ , the use of  $\text{HClO}_4$  is preferable to that of  $\text{HCl} + \text{HNO}_3$  as the ppt. does not adhere to glass and is more easily filtered. In the cinchonine method, increasing amounts of  $\text{P}_2\text{O}_5$  up to approx. 20 mg. per 100 mg. of  $\text{WO}_3$  give increasingly higher results owing to pptn. of  $\text{WO}_3 +$  cinchonine phosphotungstate, but amounts of  $\text{P}_2\text{O}_5 >$  this cause uniform but high results owing to the pptn. of (I) alone, the ignition of which gives  $\text{P}_2\text{O}_5 \cdot 24\text{WO}_3$ . L. S. T.

**Determination of uranium by isatin- $\beta$ -oxime.** V. HOVORKA and V. SÝKORA (Coll. Czech. Chem. Comm., 1938, 10, 182—189).—Addition of isatin- $\beta$ -oxime to a hot solution of a uranyl salt, followed by addition of excess of NaOAc, gives a quant. pptn. of  $\text{UO}_2(\text{C}_8\text{H}_5\text{O}_2\text{N}_2)_2$ , finally converted by ignition into  $\text{U}_3\text{O}_8$ . The method tends to give slightly high results, with an error (for wts. of  $\text{U}_3\text{O}_8$  from 0.3 to 0.01 g.) of  $<0.5\%$ . M. R.

**Development of electro-drop analysis.** V. H. FRITZ (Mikrochem., 1938, 24, 171—178; cf. A., 1938, I, 274).—The significance of the electrolyte and its solvent in the separation of similarly-reacting metals by electro-drop analysis with special reference to Bi and Sb in presence of thiocyanate and in aq. and MeOH solution is discussed. Reagents for the simultaneous detection of several metals, the detection of traces of metallic impurities in pure metals, and the masking of interfering ions are also discussed. L. S. T.

**Thermo-regulator.** N. SĂLĂGEANU (Bull. Soc. Roumaine Physique, 1938, 38, 103—108).—The heating current is interrupted by means of a lever controlled by the position of the Hg meniscus. The disadvantages of using Hg as current carrier are avoided; temp. variations of  $<0.004^\circ$  at  $28^\circ$  are recorded. M. R.

**Photo-electric thermoregulator.** N. N. AFANASIEV (Zavod. Lab., 1938, 7, 234—236).—Apparatus is described. R. T.

**Laboratory thermoregulator.** H. M. WADDLE and R. E. IMHOFF (J. Chem. Educ., 1938, 15, 191—

192).—The thermoregulator described utilises the coiling and uncoiling of a bimetal helix with changes in temp. It can be used in any position to control temp. to within  $\pm 0.3^\circ$  over a range of  $50\text{--}225^\circ$ .

L. S. T.

**Copper-phosphoric acid thermostat for kinetic measurements.** H. C. S. SNETHLAGE (Chem. Weekblad, 1938, 35, 364).— $\text{H}_3\text{PO}_4$  is a suitable liquid for thermostats at high temp. It attacks glass at  $>150^\circ$  and also Cu and brass, especially when in motion, but Cu is satisfactory at  $>160^\circ$  if the metal in contact with rapidly moving liquid is covered with a loose Cu plate. Corrosion is much more severe in presence of  $\text{H}_2\text{O}$  and the acid must be maintained at about 100%. An electrically heated thermostat is described.

S. C.

**Electric air-heater.** M. C. DE MAUNY (Bull. Soc. chim., 1938, [v], 5, 568—569).—Air is passed over a wound-wire resistance in suitable container.

M. R.

**Amorphous carbon resistance thermometer-heaters for magnetic and calorimetric investigations at temperatures below  $1^\circ\text{K}$ .** W. F. GIAUQUE, J. W. STOUT, and C. W. CLARK (J. Amer. Chem. Soc., 1938, 60, 1053—1060).—The electrical resistance characteristics of finely-divided C at low temp. have been investigated. The resistance of a C ink thermometer at  $1.63^\circ\text{K}$ . is 13,700 times that at  $293^\circ\text{K}$ . The construction of C thermometer-heaters from lampblack is described. The resistance of a C thermometer has been determined from  $293^\circ$  to  $0.129^\circ\text{K}$ . and the degree of reproducibility ascertained. Measurement of the increase of resistance in a magnetic field at  $4.2^\circ$  and  $1.5^\circ\text{K}$ . shows a greater val. at the lower temp.; at both temp. it  $\propto$  (applied field)<sup>2</sup>. The problem of possible heat development by eddy currents within the C particles during measurements requiring the presence of alternating fields is discussed. The resistance of Pt films on glass has been investigated at low temp. in connexion with their use as thermometer-heater leads.

E. S. H.

**Reference tables for iron-constantan and copper-constantan thermocouples.** W. F. ROESER and A. I. DAHL (J. Res. Nat. Bur. Stand., 1938, 20, 337—355).—From determinations of the thermo-e.m.f. of various Fe and constantan wires against a standard Pt wire (reference junction at  $0^\circ$ ) a table of the temp.-thermo-e.m.f. relations of the Fe-constantan couple from  $-200^\circ$  to  $1000^\circ$ , which is very close to the table most generally used, has been constructed. The max. deviation of any couple tested was  $>0.75\%$ . The table of thermo-e.m.f. given by Adams ("Intern. Crit. Tables," 1, 58) for the Cu-constantan couple represented closely the mean of the couples tested, and this was adopted as the standard table. Both tables are near to the mean of vals. for, and are easily reproduced by a suitable choice of the materials most commonly used. Oxidation causes very little drift of the e.m.f. of the Cu-constantan couple, but seriously affects the accuracy of the Fe-constantan junction, which should not be used above  $750^\circ$ .

R. C. M.

**Accurate determination of dew point.** A. W. HIXSON and G. E. WHITE (Ind. Eng. Chem. [Anal.],

1938, 10, 235—240).—In the apparatus and method described the dew point of confined samples is determined directly by a sensitive photo-electric means of dew observation. The marked hysteresis error characteristic of methods involving continuous temp. change is eliminated. A precision of approx.  $\pm 0.01^\circ$  at 90% humidity and  $\pm 0.05^\circ$  at 100% can be obtained. The apparatus is sufficiently sensitive to register the presence of gaseous films adjacent to the mirror of composition somewhat different from the body of gas due to localised cooling at nearly const. pressure. An hypothesis concerning the structure of gaseous films adjacent to the liquid phase is advanced, and the mechanism of dew formation and evaporation is discussed. Possible applications of accurate dew point determinations are considered.

L. S. T.

**Apparatus for determining b.p. and f.p. of solvents.** E. E. CHANDLER (J. Chem. Educ., 1938, 15, 166).

L. S. T.

**Light source for microscopy.** H. WRIGHTON (J. Roy. Microscop. Soc., 1937, 57, 260—261).—The new high-pressure "Osira" Hg vapour lamp and its characteristics are described.

N. M. B.

**Apparatus for comparing luminosity of light sources.** A. BLONDEL (Compt. rend., 1938, 206, 1231—1232).—The apparatus employs a Se photo-electric cell and is suitable for routine checking of incandescence lamps during manufacture.

J. A. D.

**Sampling visible radiation.** R. W. WALLACE (Plant Physiol., 1937, 12, 647—666).—A suitable arrangement of photo-electric units is described.

A. G. P.

**Principles of fluorescence microscopy.** J. E. BARNARD and F. V. WELCH (J. Roy. Microscop. Soc., 1937, 57, 256—259).—A descriptive survey.

N. M. B.

**Apparatus for viewing varying thicknesses of solution with a direct-vision spectroscope.** G. A. HARRISON (Biochem. J., 1938, 32, 933—935).—By means of a plunger arrangement depths  $>5$  in. thick can be examined using 5 ml. of liquid.

A. L.

**Objective spectral colorimeter.** II. E. LANDT and H. HIRSCHMÜLLER (Z. Wirts. Zuckerind., 1938, 88, 247—279; cf. A., 1937, I, 534).—The errors inherent in the apparatus and its operation are discussed. Taking due precautions, the error of measurement should not exceed 2%. Typical results are recorded for turbid and clear solutions of sugar products.

E. S. H.

**Photo-electric colorimeter for determination of silver in used [photographic] thiosulphate baths.**—See B., 1938, 733.

**Large quartz monochromator for biophysical research.** F. M. UBER and S. JACOBSON (Rev. Sci. Instr., 1938, 9, 150—152).—The instrument provides for the simultaneous irradiation of 15 different samples of 100 sq. mm. area and two of 75 sq. mm. area placed horizontally and each exposed to a single  $\lambda$  of the Hg arc spectrum for the range  $\lambda\lambda$  3655—2352 Å. The sample holder can be exchanged for a photographic film holder or a calibrated

traversing slit mechanism carrying a thermopile or photo-cell. N. M. B.

**Intensifying screens in X-ray diffraction work.** C. GAMERTSFELDER and N. S. GINGRICH (Rev. Sci. Instr., 1938, 9, 154—159).—Exposure time-density curves for monochromatic X-ray diffraction patterns of liquids are given for a Fluorazure intensifying screen which reduces exposure time and increases intensity by a factor 1—13.3 for Mo  $K\alpha$  radiation and 1—4 for Cu  $K\alpha$  radiation for increasing intensities or exposure times. With this screen true intensity measurements cannot be made. Curves are also given for two ordinary X-ray films in contact and for a new type of double emission film which reduce exposure time and permit true intensity measurements.

N. M. B.

**Transport of material in sources for spectroscopic analysis.** G. O. LANGSTROTH and D. R. McRAE (Canad. J. Res., 1938, 16, A, 61—74).—When an image of the light source is focussed on the spectrograph slit, the intensity ratio of the lines due to the internal standard and investigated element, respectively, depends on the point in the source from which the examined light is radiated. This ratio may depend so strongly on the nature of extraneous matter in the sample as to vitiate precision measurements. The effects of variations in transport mechanism in the spark discharge can be minimised by addition of excess of a suitable salt (containing an element of low ionisation potential) as spectroscopic buffer, and by choice of an appropriate internal standard element. The mechanism of transport is discussed. E. S. H.

**Technique of formation of Hartley figures. Mode of operation.** C. DUFRASSE and J. HOUPIILLART (Bull. Soc. chim., 1938, [v], 5, 309—322).—Defects in the representation of absorption spectra by means of Hartley figures are discussed, and a photographic method of correction of the figures is described. E. S. H.

**Experimental conditions for half-shadow polarimetry.** R. TSUCHIDA (Bull. Chem. Soc. Japan, 1938, 13, 353—356).—Optimal conditions for the polarimetry of coloured substances are deduced theoretically. F. L. U.

**Loss of definition of X-ray photographs by the use of intensifying foils.** H. NITKA (Physikal. Z., 1938, 39, 436—439). A. J. M.

**Apparatus for recording photographically the linear expansion of metals. Expansion coefficients of copper and nickel.** E. ROSENBOHM (Physica, 1938, 5, 385—398).—The expansion of a short bar of metal opens a slit on which is focussed an image of the filament of an incandescence lamp and causes a corresponding amount of light to fall on the sensitive part of a Moll thermopile. The current produced is measured by a reflecting galvanometer by projecting the reflected light either on to a screen or on to a photographic plate. In this way, the change in length of the test-piece is magnified 1000 times. The linear expansion coeffs.,  $\alpha$ , of Cu and Ni have been measured from 0° to 400° and 0° to 520°, respectively.

For Cu  $\alpha$  increases uniformly but for Ni it shows an irregularity at the Curie point. T. H. G.

**Response of barrier-layer cells to X-rays of long wave-length.** A. E. SANDSTRÖM (Nature, 1938, 141, 873).—Photo-electric Se cells are susceptible to X-rays of  $\lambda$  somewhat  $<20 \text{ \AA}$ . The photo.e.m.f. is  $\sim 10^{-4}$  v. Below 0.9  $\mu$ -amp., the photocurrent is a rectilinear function of the intensity.

L. S. T.

**Scale for determining the refractive indices of molten organic substances.** L. KOFLER and H. RUESS (Chem. Erde, 1938, 11, 590—591; cf. A., 1930, 314; A., 1937, I, 427).—A scale for use by the immersion method consists of a series of 24 fluorite and glass powders with  $n$  ranging from 1.4339 to 1.6718.

L. J. S.

**Simple Wilson chamber for demonstration.** G. RATHENAU (Physica, 1938, 5, 427—429).—The instrument, which is described and figured, is designed for direct observation. It is simple, cheap, and portable. T. H. G.

**Vacuum tube control circuit for cloud chambers.** J. R. RICHARDSON (Rev. Sci. Instr., 1938, 9, 152—154).—An improved form of the circuit described by Jones (cf. A., 1937, I, 582) with elimination of the usual motor and cam arrangement.

N. M. B.

**Scale-of-two counter.** H. ALFVÉN (Proc. Physikal. Soc., 1938, 50, 538—359).—The counter described is a simplified form of that due to Lewis (cf. A., 1938, I, 101), without chokes and  $\text{Cu}_2\text{O}$  rectifiers.

N. M. B.

**Improvement in Geiger-Müller tube design.** J. L. LAWSON and A. W. TYLER (Physical Rev., 1938, [ii], 53, 605).—The use of a Cu wire shield to counteract the influence of external light and charged bodies is described. N. M. B.

**Circuit for use with Geiger-Müller counters.** E. W. YETTER (Physical Rev., 1938, [ii], 53, 612).—The circuit is similar to that of Neher and of Ruark (cf. A., 1938, I, 277) but the automatically adjustable resistance of a vac. tube is used in series rather than in parallel with the ion counter, and the discharge is cut short by increasing the series resistance to a high val. as soon as the counter discharge begins.

N. M. B.

**Influence of vapours on the spectral sensitivity curve of photo-electric counters.** R. AUDUBERT and J. MATTLER (Compt. rend., 1938, 206, 1005—1007).—The sensitivity curve of counters with Pt, Au, Ag, CuO, CdS, and Al photocathodes is independent of the nature of the gas or vapour filling the counter. With a CuI cathode, EtOH and  $\text{CO}_2$  shift the sensitivity max. from 2150 to 2350  $\text{\AA}$ , probably owing to dissolution of I in the surface layer; in I vapour the max. is at 2100  $\text{\AA}$ . A. J. E. W.

**Theoretical efficiency of cylindrical ionisation chambers when used for determining radon by  $\alpha$ -particle counting.** J. H. J. POOLE (Sci. Proc. Roy. Dublin Soc., 1938, 21, 609—614; cf. A., 1938, I, 370).—Mathematical. Since the range of  $\alpha$ -particles varies only a certain proportion of them will produce sufficient ions to cause a kick on the oscillograph

record. This proportion must be calc. for Rn, Ra-A, and Ra-C' and corr. for decay of the Rn before recording begins. Good agreement with experimental results is obtained. T. H. G.

**Transport of ions in fluid moving with super-sonic velocity.** V. VOLKOVSKY (Compt. rend., 1938, 206, 1084—1086).—An apparatus for measuring the rate of diffusion of ions in a high-velocity air blast is described. Its applications to aerodynamic problems are indicated. H. J. E.

**Experimental investigation of the second method of Drude.** I. V. I. KALININ (Abh. Staats-univ. Saratov, 1938, 14, 48—53).—The sensitivity of the method is higher if the liquid, the dielectric const. of which has to be determined, instead of being placed in a condenser, is put in a vessel in which two wires connected with the Lecher wires are dipping. J. J. B.

**Apparatus with high resolving power for cosmic rays.** R. MAZE (J. Phys. Radium, 1938, [vii], 9, 162—168).—The system of Neher and Harper (A., 1936, 1084) is developed to give increased resolving power. O. D. S.

**Indirect observation of structural changes at high temperatures, using the electron microscope.** J. P. SELISKI (Zavod. Lab., 1938, 7, 114—115).—Transformation of  $\alpha$ - into  $\gamma$ -Fe, or the reverse change, may be followed with the aid of an electron microscope. R. T.

**Mass spectrometer with improved focussing properties.** W. BLEAKNEY and J. A. HIPPLE, jun. (Physical Rev., 1938, [ii], 53, 521—529).—A discussion of the use of crossed electric and magnetic fields indicates that this arrangement has perfect focussing properties depending only on the  $m/e$  of the ion selected and not on the velocity or direction of the charged particles entering the analyser. The two types of path (curtate and prolate cycloids), the construction of the projection of the path (a trochoid) in the plane perpendicular to the magnetic field, and the design and construction of apparatus for the two types of path are discussed, and typical mass-spectra (for  $C_2H_6$ ) are shown. N. M. B.

**Positive ion source for nuclear research.** J. S. ALLEN (Rev. Sci. Instr., 1938, 9, 160).—In the arrangement described the distance between the anode and filament is short to ensure easy starting. A glass shield confines the arc to a small region near the probe. N. M. B.

**Selenium photo-cells and their use.** W. BEHRENDT (Z. tech. Phys., 1938, 19, 92—97).—The characteristics and uses of a no. of types of cell are reviewed. A. J. E. W.

**Method for preparing glass electrodes.** M. L. NICHOLS and J. M. SCHEMPF (Ind. Eng. Chem. [Anal.], 1938, 10, 286).—The procedure described gives a sensitive, durable electrode which can be used with an ordinary galvanometer. L. S. T.

**Vacuum-tight seal for electrodes with high insulation.** R. D. BRADFIELD (Canad. J. Res., 1938, 16, A, 76). E. S. H.

**Cathode-ray furnace with regulable electrodes.** F. TROMBE (Bull. Soc. chim., 1938, [v], 5, 712—715; cf. A., 1934, 859).—The discharge tube described comprises a  $SiO_2$  bulb in which the Al electrodes are held in side tubes at about  $45^\circ$  to one another, so that two beams of electrons converge on a W anticathode. The materials, the effect of electrons on which it is desired to investigate, can either be submitted to direct bombardment in a shallow dish on the anticathode, or can be shielded from direct bombardment by enclosure in a deeper vessel. J. W. S.

**Direct-reading apparatus for measuring magnetic fields.** R. SERVANT and B. TSAI (Compt. rend., 1938, 206, 1172—1174).—The instrument consists of a coil carrying a const. current, rotating against a hairspring about an axis perpendicular to the magnetic field; the deflexion of the coil is read with a suitable pointer and scale. Accuracy to 1% is claimed, and the instrument may be used for widely varying field strengths by adjustment of the current through the coil. A. J. E. W.

**Automatic zero burette.** P. REISS (Bull. Soc. chim., 1938, [v], 5, 569—571).—The burette is provided with a tap allowing two-way communication to a titration flask or to a reservoir. Air enters the reservoir by a vertical tube bent at right angles under the surface of liquid at a suitable level. M. R.

**High-vacuum gas analysis apparatus.**—See B., 1938, 612.

**Apparatus for detection of gas traces. Hydrogen sulphide.**—See B., 1938, 736.

**Compensational polarographic method.** J. S. LIALIKOV (Zavod. Lab., 1938, 7, 24—29).—A compensational method is described. R. T.

**Mercury U-gauge.** A. ZIMMERLI (Ind. Eng. Chem. [Anal.], 1938, 10, 283—284).—A modification designed to overcome the disadvantages of the usual U-shaped Hg manometer for measuring moderately low pressures is described. L. S. T.

**Bottle-shaking apparatus.** G. W. SMITH (Ind. Eng. Chem. [Anal.], 1938, 10, 282—283).—The device consists essentially of a circular platform mounted at an angle of  $15^\circ$  on a vertical motor-driven shaft. Six 125-ml. Erlenmeyer flasks are shaken at a time. L. S. T.

**Reciprocating laboratory shaker.** E. R. SCHWARZ and L. SHAPIRO (Ind. Eng. Chem., 1938, 10, 281—282).—The shaker is suitable for washing fabrics. Air is quickly displaced; wetting is complete in a few sec. and washing in  $<15$  min. L. S. T.

**Simple high-vacuum release valve.** R. JACKSON and A. G. QUARRELL (J. Sci. Instr., 1938, 15, 208).—A Schrader tyre valve has been adapted to admit air to all-metal vac. apparatus. J. A. D.

**Constant-pressure valve.** K. S. WILLSON (Ind. Eng. Chem. [Anal.], 1938, 10, 279—280).—The valve described permits removal of gas at a const. pressure independent of the back pressure on the exhaust line. It also serves as a safety manometer to prevent excessive pressure in a system. L. S. T.

**Pressure regulator.** F. TROMBE (Bull. Soc. chim., 1938, [v], 5, 710—712).—A regulator designed



to give const. pressure reduction as a gas passes from one vessel to another comprises a U-tube, the amount of Hg in which can be regulated, one side of which is connected to each vessel. A float on the Hg in the limb connected to the vessel at higher pressure serves to close a connexion between the two vessels when the pressure difference is too low. J. W. S.

**Sensitive manostat for low gas pressures.** T. SOLLER, S. GOLDWASSER, and R. A. BEEBE (J. Amer. Chem. Soc., 1938, 60, 1265—1266).—A correction. The photo-electric relay circuit described (A., 1936, 1355) should include a grid leak. E. S. H.

**Surface viscosimetry.** W. D. HARKINS and J. G. KIRKWOOD (J. Chem. Physics, 1938, 6, 298).—A reply to criticism (cf. Dervichian and Joly, A., 1938, I, 135). W. R. A.

**Separation of gaseous isotopes by diffusion.** R. SHERR (J. Chem. Physics, 1938, 6, 251—259).—The isotopic separation factors per pump in a set of Hg diffusion pumps have been determined for Br in MeBr (1-005), C in CH<sub>4</sub> (1-107), O in O<sub>2</sub> (1-045), O in H<sub>2</sub>O (1-073), Ne (1-198), and A (1-154). Theoretically derived formulæ for enrichment are discussed. Attempts to modify the pumps and increase their efficiency are described. W. R. A.

**Crystal model construction.** K. M. SEYMOUR (J. Chem. Educ., 1938, 15, 192—194).—The construction of models of LiCl, CaF<sub>2</sub>, CdI<sub>2</sub>, etc. from sponge rubber balls and oak doweling is described. L. S. T.

**Combination funnel support and burette clamp.** P. S. CHEN (J. Chem. Educ., 1938, 15, 190).—The hand screw on the usual type of clamp is replaced by a screw with a ring at one end. L. S. T.

**Determination of the vapour densities of indigo and other organic compounds by means of a spoon gauge.** C. E. DENT and R. P. LINSTEAD (J.C.S., 1938, 715—717).—The pressures exerted by a known wt. of substance completely volatilised in a known vol. at measured temp. have been measured. The gauges used were sensitive to pressure differences of 1 mm. Mol. wts. found were: phthalimide 147.5 (C<sub>8</sub>H<sub>5</sub>O<sub>2</sub>N = 147), indigo 257 ± 9 (C<sub>16</sub>H<sub>10</sub>O<sub>2</sub>N<sub>2</sub> = 262), phthalonitrile polymeride 396 ± 25[(C<sub>8</sub>H<sub>4</sub>N<sub>2</sub>)<sub>3</sub> = 384]. M. R.

**Water as a reference standard for ebullimetry.** W. SWIENTOSLAWSKI and E. R. SMITH (J. Res. Nat. Bur. Stand., 1938, 20, 549—553).—The properties of H<sub>2</sub>O are discussed with reference to its suitability as a primary standard for comparative ebullimetric measurements. The influence of small differences in isotopic composition are shown to be negligible. Equations are given for obtaining the b.p. of H<sub>2</sub>O to 0.001° at any pressure between 660 and 860 mm., and vice-versa. D. F. R.

**Ultracentrifuge.** J. W. MCBAIN and F. A. LEYDA (Nature, 1938, 141, 913—914).—The ultracentrifuge designed is a modification of the air-driven spinning top; this procedure dispenses with an optical system, and depends on direct analysis by a suitable method of the liquid after centrifuging. Results

obtained with the apparatus for the sedimentation const. of ovalbumin agree with those obtained with the Svedberg apparatus. L. S. T.

**Methyl methacrylate as a laboratory tool.** E. C. COLE (Science, 1938, 87, 396—398).—Uses are described. L. S. T.

**Maintaining transparency in glass observation windows.** C. W. OCKELFORD (J. Sci. Instr., 1938, 15, 190—193).—Difficulties experienced in measuring the optical density of smoke columns, due to deposits from the smoke settling on to the glass windows, were removed by maintaining the windows at a temp. 50° > that of the smoke column. J. A. D.

**Silvering glass.** F. E. J. OCKENDEN (J. Sci. Instr., 1938, 15, 206—208).—Formulae are given for the two components of a silvering mixture. Conc. HNO<sub>3</sub> is used for cleaning the articles to be silvered; NaOH or KOH is not recommended. O<sub>2</sub> dissolved in the silvering solutions oxidises the final deposit if not previously removed by gentle boiling of the respective solutions before mixing. Full practical details are given. J. A. D.

**Distillation apparatus for water with automatic feed and removal of residue.** P. STADLER (Chem.-Ztg., 1938, 62, 369). E. C. S.

**Aids to vacuum distillation.** T. S. GARDNER (J. Chem. Educ., 1938, 15, 194).—A sliver of glass fused on to the end of the tube leading from the distilling flask breaks up drops of liquid that would be entrained and causes their return to the flask. A special form of seal prevents breakage of the condenser when the apparatus is disconnected. L. S. T.

**High-vacuum fractional distillation without gravitational reflux.** G. VON ELBE and B. B. SCOTT (Ind. Eng. Chem. [Anal.], 1938, 10, 284—286).—The mixture to be fractionated is placed in a long, evacuated glass tube along which a temp. gradient is maintained for a short distance by a thermostat system. The mixture tends to accumulate at the low-temp. end of the gradient and by pulling the tube slowly and uniformly through the gradient in the direction towards the warm end, the mixture is made to distil continuously within the gradient and to separate into its components. The method is illustrated by the separation of *p*- and *m*-xylene in a 0.01—0.1-c.c. sample. L. S. T.

**Apparatus for vacuum [fractional] distillation.** L. RAMBERG (Svensk Kem. Tidskr., 1938, 50, 107—111).—A receiver in which losses due to incomplete condensation are <2.5% is described. M. H. M. A.

**Appliance for precipitation with hydrogen sulphide, and for detection of gases.** C. N. POTSCHINOK (Ukrain. Chem. J., 1938, 13, 86—90). R. T.

**Carbon monoxide indicators.**—See B., 1938, 736.

**[Laboratory] experiments dealing with rates of dissolution [of sodium chloride].** G. W. GLEESON (J. Chem. Educ., 1938, 15, 187—190). L. S. T.

## Geochemistry.

**Geochemical data for the origin of the Melitopol natural gas reservoirs.** J. V. GRETSCHNI (Ukrain. Chem. J., 1938, 13, 91—104).—The origin of the deposits is discussed. R. T.

**Analysis of the Royal Spring at Kostrivnica.** S. MIHOLOĆ (Bull. Soc. Chim. Yougoslav., 1937, 8, 183—192).—Analytical data are recorded. R. T.

**Decompositions in shallower waters of a lake in summer and the supply of oxygen from the atmosphere.** K. SUGAWARA (Proc. Imp. Acad. Tokyo, 1938, 14, 57—60).—In warm, shallow  $H_2O$ , decomp. is more rapid than assimilation of  $O_2$  and leads to reduction of  $O_2$  content. E. S. H.

**Ecology of the Tamar estuary. III. Salinity and temperature conditions in the lower estuary.** A. MILNE (J. Marine Biol. Assoc., 1938, 22, 529—542).—Salinity and temp. conditions were studied at various points in the estuary in relation to time of year and state of tide. On a rising tide the more saline  $H_2O$  bulges up towards the surface. On a falling tide the fresher  $H_2O$  bulges downwards. Bottom-living organisms experience smallest salinity range near high- $H_2O$  mark and greatest at low- $H_2O$  mark. At high- $H_2O$  mark the variation is in the higher part of the salinity range. The period of fluctuating salinity is shorter in the upper part of the inter-tidal zone. Organisms thus meet with more favourable salinity conditions the higher they live in the inter-tidal zone. In the surface  $H_2O$  the average salinity decreases up-river but the range of variation increases. A. D. H.

**Re-examination of cliftonite.** M. H. HEY (Min. Mag., 1938, 25, 81).—An X-ray photograph of a small cube of graphite from the Younegin siderite shows it to be an oriented pseudomorph [after diamond?] with the c-axes of graphite parallel to the three [001] axes of the cube. L. J. S.

**Hornblendes from the Glen Tilt complex, Perthshire.** W. A. DEER (Min. Mag., 1938, 25, 56—74).—Detailed chemical analyses with optical data are given of 9 hornblendes from the various basic rocks of the complex. Formulæ are deduced and the results plotted. A relationship is shown between the  $SiO_2$  content of the hornblendes and that of the rocks in which they are contained. The green and brown colours of hornblendes are discussed in relation to the  $Fe_2O_3 : FeO$  ratio and the presence of  $TiO_2$  or  $Tl_2O_3$ . L. J. S.

**Russellite, a new British mineral.** M. H. HEY and F. A. BANNISTER (Min. Mag., 1938, 25, 41—55).—The mineral was found sparingly as yellow pellets in the concentrates of W ore at Castle-andinas mine, Cornwall. Micro-analyses agree approx. with  $Bi_2O_3 \cdot WO_3$ ;  $c$  7.18—7.43. X-Ray photographs show it to be tetragonal, with space-group  $D_{2d}^{13}$  or

$D_{2d}^{13}$  and cell size  $a$  5.42,  $c$  11.3 Å. Artificially prepared material with the approx. composition  $Bi_2O_3 \cdot 2WO_3$ ,  $c$  7.97—8.12, is also tetragonal with a similar structure. It is suggested that these are mixed crystals  $(Bi_2, W)O_3$ , rather than Bi tungstates. An appendix by A. RUSSELL describes the mode of occurrence and associated minerals. L. J. S.

**Molybdenite-bearing pegmatites and granites from West Tatra.** L. CHROBAK (Bull. Acad. Polonaise, 1938, A, 120—125).—Mineral content, and petrological structure, texture, and origin are described, with chemical analyses by X-ray methods. The  $MoS_2$ , hitherto unknown in this region, contains small amounts of Cl, Fe, Ba, Ca, K, Cu, Pb, and Bi. It occurs with muscovite and quartz in idiomorphic hexagonal plates, in thin ledges in feldspar, or embedded in limonite. Halos in biotite are due to  $\alpha$ -rays of range 20 and 33  $\mu$ , derived from Rn and Ra-F, and Ra-C', respectively. I. McA.

**Metamorphosis of amphibolitic rocks from Tatra.** S. KREUTZ (Bull. Acad. Polonaise, 1938, A, 116—119).—Petrological characteristics are described. Chemical and mineralogical analyses, with photomicrographs, indicate the nature of the metamorphosis (which includes pleochroic halos of radioactive origin) due chiefly to tectonic movement. I. McA.

**Sulphide silver minerals—their pyrosynthesis and their identification by selective iridescent filming.** A. M. GAUDIN and D. W. McGLASHAN (Econ. Geol., 1938, 33, 143—193).—Argentite, proustite, smithite, pyrrargyrite, miargyrite, matildite, and stromeyerite have been synthesised by heating the appropriate elements in an Fe bomb at temp. up to 800°. Four other Ag compounds synthesised are probably identical with pearcite, stephanite, polybasite, and tapalite. The phases obtained have been differentiated by selective iridescent filming with a solution composed of one vol. of 2% I-MeOH solution and one of conc.  $H_2SO_4$ . Other sulphides synthesised include chalcocite, covellite, famatinite, tetrahedrite, chalcostibite, stibnite, galena, enargite, and bismuthinite. Phase diagrams of the systems Ag-As-S, Ag-Sb-S, Ag-Bi-S, and Ag-Cu-Sb-S, all with excess of S, are reproduced and discussed, and photo-micrographs of the phases are given. Corrections in the accepted formulæ for some of the minerals are proposed. Colours obtained with the filming solution and the various sulphides are tabulated, and provide a key for their identification. L. S. T.

**Bauxites.** Z. N. NEMOVA (Trans. Petrograph. Inst. Acad. Sci. U.R.S.S., 1934, 6, 485—489).—Analyses are recorded. CH. ABS. (p)

**Chemical characterisation of Tazul marl.** I. O. ALEXANDROV (Ukrain. Chem. J., 1938, 13, 80—85).—Analytical data are recorded. R. T.