Coherence of the circular components in the Stark effect. F. SUPPE (Z. Physik, 1939, **113**, 18—27).—From an examination of the influence on the Hg resonance line 2537 A. of electric and magnetic fields, separately and together, it is deduced that the circular components of the Stark effect are coherent.
L. G. G.

Influence of the cathode on the sparking potential of hydrogen. F. L. JONES and J. P. HENDERSON (Phil. Mag., 1939, [vii], **28**, 185—191).—The sparking potential (V) of H_2 has been measured throughout a range of gas pressures of 1—520 mm. Hg, and for electrodes of clean and slightly oxidised Staybrite steel, and pure and commercial Al, Ni, and Cu. The min. val. of V increases with the work function of the cathode surface and it is lowered by impurities in the cathode and by surface oxidation.
C. R. H.

Mechanism of the spark discharge in hydrogen. F. L. JONES (Phil. Mag., 1939, [vii], **28**, 192—202).—Theoretical. The dependence of the sparking potential of H_2 on the cathode material (cf. preceding abstract) can be readily interpreted on the Townsend theory of the spark discharge.
C. R. H.

Sparking potential of deuterium. F. L. JONES (Nature, 1939, **143**, 854).—The effect of a change of cathode material is most pronounced at the min. sparking potential of D_2, which is characteristic of the metal of the cathode after it has been de-gassed. For a given metal the min. sparking potential is sensitive to the state of the cathode surface even after de-gassing. For six cathodes the min. sparking potential of D_2 is 3% > that of H_2.
L. S. T.

Intercombination lines in the spectrum of helium. P. JACQUINOT (Compt. rend., 1939, **208**, 1896—1898).—A no. of intercombination lines occurring as weak satellites of He lines at 4026—5875 A. have been obtained by high-frequency excitation of He at <0·5 mm. pressure. Certain of these lines are attributed to interactions between singlet and triplet systems, and to forbidden interactions.
A. J. E. W.

Atomic energy states of an unusual type. B. EDLÉN and F. TYRÉN (Nature, 1939, **143**, 940—941).—The vac. spark spectra of light elements (B to F) show in the region 60—15 A. groups of lines which do not fit in the ordinary series spectra, but indicate optical energy states high above the ionisation limit, having a character approaching that of X-ray levels.
L. S. T.

Positive column of the nitrogen arc at atmospheric pressure. E. S. LAMAR, A. M. STONE,

and K. T. COMPTON (Physical Rev., 1939, [ii], **55**, 1235—1244).—A simplified theory, neglecting convection, for low-current arcs is developed.
N. M. B.

Forbidden transitions in nitrogen. J. KAPLAN (Nature, 1939, **143**, 1066).—The nebular line at 3466·4 A. in at. N has been observed in a high-pressure afterglow in N_2. The weaker nebular line at 5200 A. appeared when panchromatic plates were used. High pressures and small vols. favour the production of forbidden transitions.
L. S. T.

Luminescence of the night sky. J. CABANNES (Compt. rend., 1939, **208**, 1770—1772).—The occurrence of O, first positive N, and Vegard–Kaplan bands in the night sky spectrum is satisfactorily explained by assuming that luminescence is due to O atoms formed by photochemical dissociation of O_2 mols. in daylight (cf. Chapman, A., 1937, I, 208). The energies required for excitation of the bands are considered in detail. The luminescent layer has a temp. of 700—1000° K.
A. J. E. W.

[Spectrum of] the polar aurora. R. BERNARD (Compt. rend., 1939, **208**, 1831—1833; cf. A., 1937, I, 273).—Intensity variations in the N_2^+ and N_2 (2P) band systems in different parts of the aurora are studied and discussed with reference to the origin of the discharge.
A. J. E. W.

D-Lines in the spectrum of the night sky. J. FRANCK and C. A. RIEKE (Astrophys. J., 1939, **89**, 463—464).—A discussion.
L. S. T.

New terms in Fe I, II, and III and additional far ultra-violet standards. L. C. GREEN (Physical Rev., 1939, [ii], **55**, 1209—1217).—The Fe spectrum excited in the Schüler discharge in He and Ne, and the Fe arc and spark in N_2 were investigated in the ultra-violet region λλ 2300—600. New terms are identified and unclassified levels are found in Fe II. Full data and indentifications are tabulated for about 90 lines of Fe I, 450 lines of Fe II, and 45 lines of Fe III. Some lines of accurately calc. λ in the region λλ 2225—1550 are proposed as standards.
N. M. B.

Spectra of palladium, silver, and gold between 90 and 250 A. H. SAUVENIER (Compt. rend., 1939, **208**, 1724—1725).—λλ of lines due to transitions in the M, N, and O levels are recorded; a broadening of the lines due to the Auger effect is observed. Free electron bands occur at 149, 146, and 145 A. (widths 4·5, 5·5, 5·8 e.v.) with Pd, Ag, and Au, respectively; the metals contain 0·55, 1, and 1 electron per atom in the first Brillouin zone. The mean internal potentials of the crystals are 9·5, 9·6, and 10·2 v., respectively.
A. J. E. W.

Auto-absorption of the continuous spectrum emitted by a xenon tube excited to give white light. M. LAPORTE (Compt. rend., 1939, **209**, 95—98; cf. A., 1938, I, 476).—The absorption coeff. (α) of Xe for its own radiation is deduced from a comparison of the intensities of the emitted light along and perpendicular to the axis of a long cylindrical discharge tube. For red light, $\alpha = 0.075$ per cm. at 6 mm. pressure. A. J. E. W.

Auto-absorption of the continuous spectrum of xenon excited to give white light; variation of the auto-absorption coefficient with wavelength. F. GANS (Compt. rend., 1939, **209**, 98—100; cf. preceding abstract).—A microphotometric comparison of spectrograms obtained with the tube in the two positions shows that α varies very slightly at 5000—6500 A., but increases rapidly at shorter $\lambda\lambda$, reaching 0.25 at 4000 A. A. J. E. W.

Isotopic displacement of samarium lines. M. VANJUKOV and S. FRISCH (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 39—41).—The hyperfine structure of Sm lines, particularly those at 5321 and 5252 A., has been investigated. Both lines consist of four components, the distances between which are given. The anomaly in the isotopic displacements of Sm lines has been confirmed. A. J. M.

Mechanical, magnetic, and quadrupole moments of the rare ^{176}Lu nucleus. H. SCHÜLER and H. GOLLNOW (Z. Physik, 1939, **113**, 1—9; cf. A., 1939, I, 169).—From the fine structure of the Lu II lines $\lambda\lambda$ at 6463 and 5984, the mechanical moment is ≥ 7, the magnetic moment is $\mu = 3.8 \pm 0.7$ nuclear magnetons, and the quadrupole moment $q = 6$ to 8×10^{-24} cm.^{2} The significance of the abnormally high nuclear mechanical moment in relation to radioactive decay of the ^{176}Lu nucleus is discussed. L. G. G.

Pressure gradient in the positive column. B. KLARFELD and I. POLETAEV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 460—464).—The axial pressure gradient in a uniform positive column of a Hg discharge has been measured under various conditions. In passing from the cathode to the anode there is an increase in potential gradient and in electron concn., and a decrease in electron temp. At low discharge currents the observed and theoretical vals. of the pressure gradient agree, but they diverge at larger currents. An explanation is advanced. W. R. A.

Gas rarefaction at constrictions in the positive column. B. KLARFELD and I. POLETAEV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 465—466; cf. preceding abstract).—Rarefaction of the gas at the constriction in the positive column of a Hg discharge at low pressure is indicated by the less intense illumination of the discharge in the constriction, by a decrease in pressure as compared with that on the cathode side, and by the difference in probe current characteristics in the constriction and in the broad cathode section. On increasing the discharge current the walls at the cathode end of the constriction become hot, the illumination from the discharge becomes weak, and, at a crit. current val., the discharge suddenly goes out, due apparently to extreme rarefaction. Extinction of the discharge is facilitated further by the rarefaction occurring at the axis of low-pressure discharge. The phenomena observed by Mohler (A., 1939, I, 112) in Cs vapour can be attributed probably to a lowering of pressure in the constriction in which the measurements were effected. W. R. A.

Varieties of mercury high-pressure column. R. ROMPE and P. SCHULZ (Z. Physik, 1939, **112**, 691—703).—Measurements of arc thickness in the high-pressure Hg discharge are recorded. With arcs consuming power > 500 w. per cm. at pressures >20 atm. the arc thickness is independent of the power. Between 2 and 15 atm. pressure and with 30 to 80 w. per cm. the arc thickness $\propto \sqrt{\text{power}}$. H. C. G.

Red continuous spectrum from the mercury high-pressure discharge. F. RÖSSLER (Z. Physik, 1939, **112**, 667—675).—By means of the known distribution of the intensity of light at 90° to the Hg lamp for lines of known excitation potential it is possible to determine the excitation potentials of the continuous spectrum in the visible and near infra-red. These are all ~ 8 v. The continuous spectra arise from transition between two excited levels, e.g., in the red due to $7^1P_1\Sigma^+ \rightarrow 6^1P_1\Pi$ and in the blue-green to $7^1P_1\Sigma^+ \rightarrow 6^1P_1\Sigma^+$. L. G. G.

Variation with the density of mercury vapour of the intensity of the spectral lines of mercury excited by electron impact. O. S. DUFFENDACK and O. G. KOPPIUS (Physical Rev., 1939, [ii], **55**, 1199—1208).—Using a normal low-voltage arc source, giving approx. ideal conditions, the variation was investigated for Hg alone and for Hg vapour mixed with A or He. Theoretical formulæ which give good agreement with measured vals. are developed, and the bearing of the method on quant. spectrochemical analysis is noted. N. M. B.

Spectra of the true undulatory emission of radon and of its derivatives. Rays attributable to element 85. H. HULUBEI and (MLLE.) Y. CAUCHOIS (Compt. rend., 1939, **209**, 39—42).—Using the crystal spectrograph previously described (cf. A., 1935, 58), the true undulatory emission of Rn has been studied. The spectrum contains the L emissions of elements 82, 83, and 84, of which the rays of 83 predominate. Other rays also observed are probably due to nuclear emissions. The doublets α_1 α_2 and β_1 β_2, and the γ_1 ray of 83, are accompanied by fine and intense satellites. Lines appear corresponding with $L\alpha_1$ and $L\beta_1$ of element 85 which, together with the ray $K\alpha_1$ detected previously (loc. cit.), suggests that element 85 is present among the products of disintegration of Rn. W. R. A.

Spectra of bright chromospheric eruptions from 3300 to 11500 A. R. S. RICHARDSON and R. MINKOWSKI (Astrophys. J., 1939, **89**, 347—355).—Lines showing emission over bright eruptions on the disc are 10830 A. of He, the infra-red triplet of Ca II, the Balmer series from H_a to H_t, and 3968·494, 3933·684, and 3736·919 of Ca II. In addition to these lines, bright eruptions at the limb showed 10938·12 and 10049·39 A. of H, 6678·149, 5875·79, and 4471·48 of He. No emission was observed at the limit of the Balmer series. L. S. T.

Motion of the spiral nebulæ. A. EAGLE (Nature, 1939, **143**, 856).—The shift of the spectrum lines of the spiral nebulæ towards the red may not be a Doppler effect, but the slowing down of at. vibrations predicted by the Lorentz–Larmor electro-magnetic theory. L. S. T.

Fringe of the atmosphere and the ultra-violet light theory of aurora and magnetic disturbances. S. K. MITRA and A. K. BANERJEE (Indian J. Physics, 1939, **13**, 107—144). T. H. G.

Absorption of monochromatic Röntgen rays in liquid and gaseous carbon disulphide, methylene chloride, and ethyl bromide, and in gaseous methyl iodide between 0·1623 and 1·933 a. H. HANSEN (Ann. Physik, 1939, [v], **35**, 524—546).—Absorption was measured by the filter difference method of Küstner. Mass absorption coeffs. of Cl, Br, I, and S are calc. and agree with previous vals. For Br and I the $C.\lambda^n$ law is obeyed. The absorption by Cl and S is analysed by the method of Küstner and Trübestein (cf. A., 1937, I, 208). O. D. S.

$K\beta$ lines of the oxides of magnesium, aluminium, and silicon, and of silicon carbide; origin of certain satellites. J. FARINEAU (Compt. rend., 1939, **208**, 1725—1727).—The $K\beta_x$ line of the oxides is accompanied by weaker satellites (β' and β_v), but no satellites are observed with the pure metals if air is rigorously excluded. Si in SiC gives a strong β' satellite, the aspect of the line showing a close resemblance to that of C in SiC (A., 1935, 1306). A comparison of the intensities suggests that the spatial distribution of the valency electrons is similar in the oxides and the metals. The β' line is probably associated with the discrete states occurring just below the conductivity levels (cf. Peierls, A., 1932, 896). A. J. E. W.

Optical transparency of selenium in connexion with photo-electric conduction. G. MÖNCH (Physikal. Z., 1939, **40**, 487—488).—The position of the diffuse absorption edge of the transparent modification of Se (Se II) and its variation with temp. have been determined spectrographically. The displacement of the transparency limit of Se II with temp. is approx. the same as the displacement of the photo-electric max. of grey Se (Se III), and the position of the photo-electric max. of the two forms is approx. the same at room temp. It is concluded that the photo-electric properties of Se III are due to included traces of Se II. A. J. M.

Electron transfer in argon. F. L. ARNOT and W. D. HART (Proc. Roy. Soc., 1939, **A, 171**, 383—397).—An investigation of the electron transfer process $A^{++} + A \rightarrow A^+ + A^+$ shows that the forward moving A^+ ion has an energy 13 e.v. $<$ that of the incident A^{++} ion. The angle between the directions of motion of the two ions diminishes with increasing energy of the incident ion, and is $>$ that found in the case of Hg. The cross-section for the process has been obtained. Attention is directed to a numerical error in previous work on Hg (cf. A., 1939, I, 230). G. D. P.

Electron scattering and plasma oscillations. H. J. MERRILL and H. W. WEBB (Physical Rev., 1939, [ii], **55**, 1191—1198).—An investigation of the dependence of electron scattering on plasma oscillations for low v.p. and small arc currents in a Hg-arc discharge tube showed the presence of ultimate electrons with a Maxwell–Boltzmann distribution corresponding with ~30,000° κ. and a superposed stream of fast electrons from the cathode scattered in narrow planes. The plasma oscillations showed narrow regions of large stable periodic oscillations coinciding generally with the scattering regions. Observed frequencies agreed well with the Tonks–Langmuir formula. The two regions became less marked and moved towards the cathode for increase of v.p. or arc current. Results indicated that scattering is due to plasma oscillations which receive their energy from the fast electrons. N. M. B.

Effects produced by bombarding a metallic surface with fast electrons. J. J. TRILLAT and R. MÉRIGOUX (J. Phys. Radium, 1939, [vii], **10**, 326).—Addendum (cf. A., 1939, I, 394). W. R. A.

Secondary emission of electrons from sodium films contaminated by gas. P. L. COPELAND (Physical Rev., 1939, [ii], **55**, 1270).—The secondary electron emission from thin films of Na on Ta shows rapid variation with energy of bombarding primaries of high energy similar to the variation found by Nelson for primaries of low energy bombarding oxidised films (cf. A., 1939, I, 394), and a similar explanation is discussed. N. M. B.

Electron emission of copper, silver, and aluminium on bombardment with ions of high velocity. E. GRASSMANN (Ann. Physik, 1939, [v], **35**, 465—472).—The electron emission of Cu and Ag, measured with an inhomogeneous ionic beam, varies from 40 to 86% of the no. of bombarding ions for ionic velocities from 7 to 15 kv., and that of Al varies from 300 to 440% for the same velocities. O. D. S.

Measurement of optical life-periods in an atomic jet excited by electron impact. H. BRUCK (Compt. rend., 1939, **208**, 1805—1807).—An at. jet is excited over a narrow region by a focussed transverse beam of electrons, and the path of the luminescent atoms is recorded by a spectrograph. The mean life of atoms in each level is deduced from microphotometer measurements on the corresponding spectrum line, giving the rate of decrease of intensity along the jet (cf. Koenig and Ellett, A., 1932, 439). The method is of general application. Preliminary data for certain levels of Zn, Cd, and Hg (10^{-5}—10^{-7} sec.) are given. A. J. E. W.

Effect in gases submitted to the action of ultra-violet light. G. REBOUL (Compt. rend., 1939, **208**, 2065—2067).—Exposure of gases to ultra-violet light produces large ions of mobility 0.5—0.3×10^{-3} (decreasing with time), which persist for several hr. after irradiation. These ions are of an abnormal type, as they have a pronounced ionising effect for ~30 min. after irradiation has ceased. A. J. E. W.

Stopping power of, and ion formation by, α-rays in gases. K. SCHMIEDER (Ann. Physik, 1939, [v], **35**, 445—464).—The range of, and total ionisation by, Po α-rays have been measured in air, N_2, O_2, NO, NO_2, CO, CO_2, CH_4, C_2H_4, Ne, A, and Kr, and in various mixtures of N_2 and O_2. The ionisations

in O_3 and O_2 are compared. Deviations from the at. additivity rule for stopping power are observed in N_2, NO, NO_2, and N_2O. O. D. S.

Residual ionisation of gases submitted to the action of X-rays. G. REBOUL and F. PERRIER (Compt. rend., 1939, 208, 1715—1717; cf. A., 1939, I, 169).—Recombination coeff. and mobility determinations by a special method show that the residual ionisation is due to a mixture of normal and large ions; the latter are not formed by ageing of the normal ions. A. J. E. W.

Residual ionisation of gases submitted to the action of radioactive substances. F. PERRIER (Compt. rend., 1939, 208, 2064—2065; cf. preceding abstract).—A residual ionisation persisting for several min. after exposure to Ra is due to small ions of mobility < 0.3 cm. per v. per cm. The recombination coeff. decreases from 6×10^{-6} to 8×10^{-7} in 10 min. A. J. E. W.

Collision cross-section of K atoms and K_2 molecules in gases. P. ROSENBERG (Physical Rev., 1939, [ii], 55, 1267; cf. Rosin, A., 1935, 1295).—Measurements, under identical conditions, by a mol. beam method for K and K_2 scattered in H_2, D_2, He, A, and N_2 are reported. The ratio of effective collision cross-section of K_2 to K is ~ 1.2, except for scattering in D_2, for which the val. is 1·36. N. M. B.

New prospects in isotope separation. H. S. TAYLOR (Nature, 1939, 144, 8—9).—A review. L. S. T.

Discrepancies in the isotopic weight of ^{12}C. F. W. ASTON (Nature, 1939, 143, 797—798).—The discrepancies between the author's val. and those of Mattauch (A., 1939, I, 114) and of Jordan and Bainbridge are discussed critically. L. S. T.

Masses of ^{12}C and ^{14}N. T. ASADA, T. OKUDA, K. OGATA, and S. YOSHIMOTO (Nature, 1939, 143, 797).—Measurements of the mass differences of $^{12}CH_4$ — ^{16}O and of $^{12}CH_2$ — ^{14}N give calc. vals. of 12.00394 ± 0.00018 and 14.00761 ± 0.00021 for ^{12}C and ^{14}N, respectively, using $^1H = 1.00812 \pm 0.00004$. L. S. T.

Isolation of the light isotope of chlorine, at. wt. 34·979, in the separation tube. K. CLUSIUS and G. DICKEL (Naturwiss., 1939, 27, 487).—^{35}Cl has been isolated (99·6% pure) using the method of thermo-diffusion with a separation tube 20 m. long. A. J. M.

Impulse of recoil by β-decay. L. A. SLIV (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 340—342).—Mathematical. W. R. A.

β- and γ-rays of actinium-B and actinium-C''. B. W. SARGENT (Canad. J. Res., 1939, 17, A, 82—102; cf. A., 1938, I, 488).—There is evidence that the β-spectrum of Ac-B consists of a strong and a weak primary component, of end-points 1·39 and 0·5 Me.v., respectively, the difference equalling that of a γ-ray emitted in the transformation Ac-$B \rightarrow$ Ac-C. The ratio of no. of β-particles in the two primary spectra is ~ 1.7, which approximates to that obtained from the intensities of the γ-rays. D. F. R.

Shape of the β-spectrum in the case of the forbidden transitions. V. BERESTECKI (Compt. rend.

Acad. Sci. U.R.S.S., 1939, 23, 450—454).—Mathematical. W. R. A.

Lower limit of the continuous β-spectrum of radium-E. A. FLAMMERSFELD (Z. Physik, 1939, 112, 727—743).—A β-ray spectrograph suitable for work with energies as low as 5 ke.v. is described. By using thin films of radioactive prep. (0·1 μ.) as source, the secondary effects produced by scattering in the thin foil covering the counter-tube aperture, and by re-irradiation from the substrata of the source itself, were measured and found to be comparatively great below 25 ke.v. Measurements free from these secondary effects were made with a Ra-E prep. over the range 25—1170 ke.v. Results do not agree well with the energy distribution curves derived from the theory of β-decomp. by either Fermi or Konopinski and Uhlenbeck. H. C. G.

γ-Rays of different substances from the active actinium deposit. S. DE BENEDETTI (J. Phys. Radium, 1939, [vii], 10, 294—295).—The absorption of the γ-radiation of the active deposit of Ac in equilibrium with its derivatives has been studied and Ac-C'' has been isolated. Its radiation consists partly of weak rays (energy $\leqslant 80$ ke.v.) which are absorbed by 0·5 mm. Pb. The different components of the active deposit are tentatively assigned to relative disintegrations. Most of the hard rays are due probably to the transformation Ac-$B \rightarrow$ Ac-C (830 ke.v.). W. R. A.

Energy of hard-γ-rays. B. S. DSHELEPOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 24—27). —A new method for measuring the energy of hard γ-rays, involving the use of two counters in a magnetic field, is described. Coincidence of discharges occurs when the electron and positron of one pair enter different counters. The measurement of the no. of coincidences with varying magnetic field gives a linear spectrum. The lines appear only when the energies of the electrons and positrons are $\frac{1}{2}(h\nu - 2m_0c^2)$. The γ-radiation emitted by the excited ^{12}C nucleus was investigated with the apparatus. The energies obtained agree with those formerly observed, but the intensity ratio is different. The ratio of intensities of the rays of energy 4·2 and 6·7 Me.v. was 14 : 1. A. J. M.

Radiations from radiomanganese. J. V. DUNWORTH (Nature, 1939, 143, 1065).—Single counter absorption measurements of the β-particles from ^{56}Mn and the results of β–γ and γ–γ coincidence measurements are recorded. The former are consistent with a β-particle spectrum composed of partial spectra, with max. energies of 1·2 and 2·9 Me.v., in the ratio of 0·40 : 0·60. The level scheme obtained for the disintegration of ^{56}Mn from these measurements predicts a γ-ray of 600 ke.v. energy and high intensity. This has been confirmed [A. G. WARD] by using a pressure ionisation chamber. L. S. T.

Half-periods of actinium-B, actinium-C'', and uranium-X_1. B. W. SARGENT (Canad. J. Res., 1939, 17, A, 103—105).—The half-periods are recorded as follows: Ac-B, 36.1 ± 0.2 min.; Ac-C'', 4.76 ± 0.02 min.; U-X_1, 24.1 ± 0.2 days. F. J. G.

Scattering of *D* group neutrons. M. KIMURA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 153—164).—The back-scattering cross-sections of *C* and *D* group neutrons have been measured for a large no. of elements. In many cases differences between the *C* and *D* cross-sections were observed. *D* neutron absorption cross-sections for several elements were estimated from the saturation val. of the back-scattering intensity. D. F. R.

Angular distribution of the fast neutrons scattered by atoms. S. KIKUCHI, H. AOKI, and T. WAKATUKI (Physical Rev., 1939, [ii], **55**, 1264—1265).—The differential cross-sections at different scattering angles determined for Pb and C by using ring scatterers of different sizes show that scattering by C is approx. spherically symmetric, but marked asymmetry is shown by Pb. N. M. B.

Disintegration of nitrogen by fast neutrons. E. BALDINGER and P. HUBER (Nature, 1939, **143**, 894).—Bombardment of N_2 with fast neutrons obtained by the reaction ^2D $(^2D, ^1n)$ ^3He gives 1.63×10^{-25} and 0.4×10^{-25} sq. cm. for the cross-sections of the reactions ^{14}N $(^1n, ^4\alpha)^{11}B$ and ^{14}N $(^1n, ^1H)$ ^{14}C, respectively. The reaction energy for the $^{14}N \rightarrow ^{11}B$ transformation is -0.43 Me.v. L. S. T.

Short-range α-particles from oxygen, nitrogen, and fluorine bombarded with protons. W. E. BURCHAM and C. L. SMITH (Nature, 1939, **143**, 795—796; cf. A., 1939, I, 397).—A group of α-particles of mean range 0·8 cm. is emitted from a BaF_2 target bombarded with 330-kv. protons (cf. *ibid.*, 54). These particles follow approx. the same resonance curve as that obtained for the γ-rays from proton-bombarded F. At 500 kv. bombarding energy, O_2 emits a group of α-particles of range 2.07 ± 0.05 cm. and N_2 one of 2.57 ± 0.05 cm. range. These groups are assigned to the reactions $^{18}O + ^1H \rightarrow ^{15}N + ^4He + 3.96 \pm 0.15$ Me.v. and $^{15}N + ^1H \rightarrow ^{12}C + ^4He + 5.00 \pm 0.15$ Me.v., respectively. Vals. obtained for the masses of ^{18}O and ^{12}C are 18.0050 ± 0.0004 and 12.0038 ± 0.0004, respectively. L. S. T.

Excitation function for iron by energetic deuterons. J. M. CORK and B. R. CURTIS (Physical Rev., 1939, [ii], **55**, 1264).—Fe foils after exposure to high-energy deuterons from a cyclotron were examined for activity. The energy–activity curve for the 18-hr. Co formed by a (*D*, *n*) reaction shows saturation at 7 Me.v, compared with the expected val. 10—12 Me.v. (cf. Konopinski, A., 1938, I, 430). N. M. B.

Long-lived radioactive ^{55}Fe. J. J. LIVINGOOD and G. T. SEABORG (Physical Rev., 1939, [ii], **55**, 1268—1269; cf. A., 1938, I, 427).—Continued observations over 22 months on the chemically separated Fe fractions from deuteron-bombarded Fe samples show that the 47-day period (^{59}Fe) is accompanied by a much weaker activity of very long half-life attributed to ^{55}Fe formed through ^{54}Fe (*D*, *p*) ^{55}Fe with the activity probably leading to stable ^{55}Mn by positron emission or by *K*-electron capture. N. M. B.

K-electron capture, nuclear isomerism, and the long-period activities of titanium and scandium. H. WALKE, E. J. WILLIAMS, and G. R. EVANS (Proc. Roy. Soc., 1939, **A**, **171**, 360—382).—

A study was made of the activities induced in Ti and Sc by high-energy deuterons and in Ti by activation with 11-Me.v. α-particles. A radioactive isotope of V has been discovered which decays by *K*-electron capture, ascribed to ^{47}V. An isomeric form of ^{51}Ti which decays by emitting electrons was detected, the product nucleus ^{51}V being left in an excited state. The branching decay of ^{46}Sc by *K*-electron capture and electron emission was observed. The half-life and energy of the disintegrations were measured. G. D. P.

Artificial radioactivity of lead produced by neutrons. H. DE VRIES and G. DIEMER (Physica, 1939, **6**, 599—600; cf. Pool *et al.*, A., 1937, I, 490).—Chemical separations in conjunction with counter measurements show that bombardment of Pb with fast or slow neutrons gives an element of period 80 min. (β-active, half-val. thickness of Al 0·1 mm.), which is probably a Pb isotope produced by a (*n*, 2*n*) reaction. A 5 min. period is traced to impurity, probably Zn. A. J. E. W.

Fission of heavy nuclei : a new type of nuclear disintegration. N. FEATHER (Nature, 1939, **143**, 877—879, 1027).—A review of progress. L. S. T.

Emission of neutrons accompanying the fission of uranium nuclei. J. ROTBLAT (Nature, 1939, **143**, 852).—Comparison of the neutron effects of U with those of Cu and Al shows that when bombarded by neutrons from Rn + Be, U gives off more neutrons than either Cu or Al. The apparent excess of neutrons given off by U nuclei probably represents the neutron shower accompanying the fission of an activated U nucleus (cf. A., 1939, I, 233) ; it is not due to inelastic scattering of neutrons or to the reaction (*n*, 2*n*). The calc. no. of neutrons emitted in a single fission is 6. L. S. T.

Energy and range of the heavy uranium residues. O. HAXEL (Z. Physik, 1939, **112**, 681—688).—Bombardment of U with slow neutrons gives rise to two sharply-defined groups of particles the ranges of which $\propto$ their energies. The masses and charges are inversely related to the energies and ranges. L. G. G.

Stability of uranium and thorium for natural fission. W. F. LIBBY (Physical Rev., 1939, [ii], **55**, 1269).—A review of available evidence and experimental data indicates that no fission similar to that induced by neutron absorption can occur naturally for either U or Th. N. M. B.

Further disintegration products of the bombardment of uranium with neutrons. O. HAHN and F. STRASSMANN (Naturwiss., 1939, **27**, 529—534).—Further investigation of the Cs, Rb, Xe, Kr, I, and Br isotopes, which, together with those formerly described, are produced by the bombardment of U with neutrons, has been carried out. Cs isotopes of half-life 6 min. (Cs III) and 33 min. (Cs IV) give rise to Ba of half-life 86 min. (Ba III) and 300 hr. (Ba IV), respectively. Ba II with half-life 14 min. gives rise to an active La isotope. The processes involved are : $_{92}U + n \rightarrow ^{88}_{36}Kr \rightarrow (\beta, 3 \text{ hr.}) \, ^{88}_{37}Rb \rightarrow (\beta, 17 \text{ min.}) \, ^{88}_{38}Sr + _{56}Ba \rightarrow (\beta, 14 \text{ min.}) \, _{57}La \rightarrow (\beta, \sim 2.5 \text{ hr.}) Ce (?); ^{139}_{54}Xe \rightarrow (\beta, ?) \, ^{139}_{55}Cs \rightarrow (\beta, 6 \text{ min.}) \, ^{139}_{56}Ba \rightarrow (\beta, 86 \text{ min.}) \, ^{139}_{57}La \text{ (stable)}; Xe \rightarrow (\beta, \sim 15 \text{ min.})$

Cs → (β, 33 min.) Ba → (β, 300 hr.) La → (β, 36 hr.) Ce (?). Four active I isotopes are produced from Te by β-change. Te isotopes of half-life 43 min., 66 hr., 1 hr., and 30 hr. give rise to I isotopes of half-life 57 min., 2·3 hr., 18·5 hr., and 8 days, respectively. The breakdown product of the I isotopes is probably Xe. Two weak Br isotopes are also amongst the products of disintegration of U when bombarded with neutrons. Their half-lives are 35 min. and ∼230 min.

A. J. M.

Breakdown products from the irradiation of uranium with neutrons. Strontium isotopes. C. LIEBER (Naturwiss., 1939, **27**, 421—423).—The radioactive Sr isotopes produced by breakdown of U when bombarded with neutrons have been investigated. Three Sr isotopes with half-life periods 7 min., 6 hr., and 54 days, respectively, were detected. The second of these gives rise to a Y isotope of half-life 3·5 hr.

A. J. M.

Tracks on photographic plates of the recoil nuclei of disintegration of uranium. L. MYSSOWSKY [MISSOVSKI] and A. JDANOFF [SHDANOV] (Nature, 1939, **143**, 794—795).—Tracks on photographic plates with a thick coat of emulsion of recoil nuclei produced by the action of neutrons on U have a range close to that of the α-particles of U. The no. of recoil nuclei having ranges >1·5 cm. in air is ∼100 per sq. cm. per min. (cf. A., 1939, I, 233). Irradiation of Bi, Au, and Pt for hr. with neutrons from a cyclotron produced no recoil nuclei.

L. S. T.

Detection of recoil nuclei in bombardment of uranium with neutrons. A. SHDANOV and L. MISSOVSKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 135—136).—A photographic plate was exposed for 40 min. near a U salt bombarded with slow neutrons. Microscopic examination revealed in addition to γ-ray fog, α-particles, and protons a no. of tracks 2—3 times as dense as those of the α-particles. These tracks, which were not produced by either U or neutrons alone, were attributed to heavy recoil nuclei from U.

J. A. K.

Tracks of recoil nuclei in the disintegration of uranium by neutrons. A. SHDANOV, L. MISSOVSKI, and M. MISSOVSKAJA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 338—339).—Powdered U metal, when bombarded by neutrons from a cyclotron and photographed using special emulsions, exhibits two characteristic tracks >1·5 cm. in air; one track arises from α-particles and the other, which is thicker and more continuous, from recoil nuclei. It is estimated that a plate of 6 sq. cm. receives ∼600 recoil nuclei per min. This estimate agrees with that of Frisch (A., 1939, I, 233) but not with that of Roberts *et al.* (*ibid.*, 234). The energy of recoil nuclei is ∼35 Me.v. Similar experiments with Bi, Au, and Pt gave no tracks for recoil nuclei.

W. R. A.

Energy of neutrons liberated in the nuclear fission of uranium induced by thermal neutrons. H. VON HALBAN, jun., F. JOLIOT, and L. KOWARSKI (Nature, 1939, **143**, 939).—Secondary neutrons liberated in U irradiated with thermal neutrons can communicate to O nuclei in an O_2-filled ionisation chamber recoil energies of ∼2·5 Me.v. The second-

ary radiation contains, therefore, neutrons possessing an energy of ≮11 Me.v.

L. S. T.

Control of the chain reaction involved in fission of the uranium nucleus. F. ADLER and H. VON HALBAN, jun. (Nature, 1939, **143**, 793).—The energy liberation of the nuclear reaction chain which is possible in the fission of a U nucleus by neutrons is discussed. The addition of a small quantity of an absorbent such as Cd provides the possibility of controlling the energy liberation. The system will become stable at a temp. which is characteristic of the chemical composition and dimensions of the system.

L. S. T.

Decay curves of uranium and thorium fission products. T. BJERGE, K. J. BROSTRØM, and J. KOCH (Nature, 1939, **143**, 794).—Decay curves for the disintegration of U by fast and by slow neutrons and for the disintegration of Th all have the same shape. The curves do not show whether different U isotopes are responsible for the fission produced by slow and by fast neutrons.

L. S. T.

Statistical calculation of composite decay curves. O. R. FRISCH (Nature, 1939, **143**, 852—853).—The radioactive decay curve of the U fission products is compared with a curve calc. on simple statistical assumptions concerning the distribution of decay periods. The agreement indicates that the individual features of the decay curves of Th and U are practically eliminated by the large no. of decay periods (see above).

L. S. T.

Apparent existence of a very penetrating radiation from radium and (radium + beryllium). M. E. NAHMIAS, F. L. HOPWOOD, T. E. BANKS, W. H. RANN, and L. G. GRIMMETT (Nature, 1939, **143**, 1065—1066).—The supposed penetrating radiation from Ra and Ra + Be consisting possibly of mesotrons (A., 1935, 426; A., 1939, I, 174) is shown to be due entirely to γ-rays excited by neutrons in the Pb protection around the Geiger–Müller counter.

L. S. T.

Geiger-counter measurements of the vertical cosmic-ray intensity between sea level and 24,000 ft. W. F. G. SWANN and W. E. DANFORTH (J. Franklin Inst., 1939, **228**, 43—61).—Data were obtained with 10 pairs of Geiger counter telescopes with vertical axis, impulses resulting from the passage of a cosmic ray through one of the telescopes being recorded photographically. A relative vertical intensity curve for observations at sea level and at four altitudes up to 24,000 ft. is given and analysed. A mathematical examination of the comparison of Geiger–Müller with ionisation measurements is developed and discussed in relation to the constituents of the components of cosmic rays.

N. M. B.

Showers in cosmic rays. II. W. HEISENBERG (Z. Physik, 1939, **113**, 61—86; cf. A., 1937, I, 6).—A theoretical examination of the conditions for production of multiple processes in the light of Yukawa's theory.

L. G. G.

Alfvén's hypothesis of a "cosmic cyclotron." E. R. SABATO (Physical Rev., 1939, **55**, 1272—1273; cf. A., 1937, I, 6, 340).—A criticism.

N. M. B.

The meson and its transformation into heavy particles. R. C. MAJUMDAR and D. S. KOTHARI (Nature, 1939, **143**, 796—797).—When the initial energy of a meson is $>2 \times 10^9$ e.v. the probability of transformation into a proton and a neutron is high. The protons and neutrons found in cosmic rays may be due to the spontaneous transformation of mesons of very high energies.　　L. S. T.

Mesotron and directional distribution of cosmic rays. P. WEISZ (Naturwiss., 1939, **27**, 501).—Assuming that the height at which mesotrons are produced is 0·9 of the height of the homogeneous atm., the decomp. path, L, of the mesotron is ~13 km. at sea-level.　　A. J. M.

Search for heavy cosmic-ray particles with a cloud chamber. G. HERZOG (Physical Rev., 1939, [ii], **55**, 1266).—An anticoincidence amplifying set was used to trip the cloud chamber only by those cosmic-ray particles having a further path below a given range and for which mass differences can be detected by ionisation in a cloud chamber. In 118 photographs with a large Wilson chamber, no case showing any observable difference of ionisation from fast electrons was found (cf. Street, A., 1938, I, 9), emphasising the rarity of occurrence of the terminal portion of a mesotron track.　　N. M. B.

High-altitude cosmic radiation measurements near the north geomagnetic pole. H. CARMICHAEL and E. G. DYMOND (Proc. Roy. Soc., 1939, **A**, **171**, 321—344; cf. A., 1938, I, 382).—Measurements were carried out in geomagnetic latitude 85° N. by means of a triple coincidence apparatus with radio transmission of the data and a self-recording ionisation apparatus. Comparison of the results with those obtained in lower latitudes shows that no appreciable quantity of low-energy cosmic radiation reaches the earth from outer space, and that there is no incoming radiation in the energy range 3×10^7 to ~10^9 ev. Details of the design of the apparatus are given (cf. following abstract).　　G. D. P.

Upper air investigations in North-West Greenland. H. CARMICHAEL and E. G. DYMOND (Proc. Roy. Soc., 1939, **A**, **171**, 345—359).—Observations were made in latitude 76° N. of pressure, temp., and wind speed at heights up to 20 km. A well marked tropopause was found at 11·2 km. and an unusual rise of temp. in the stratosphere; the pilot balloons showed very still air in the stratosphere and a marked velocity max. at 9 km. in the troposphere.　　G. D. P.

Cosmic-ray bursts at high altitudes. H. J. J. BRADDICK (Proc. Roy. Soc., 1939, **A**, **171**, 314—321). —Measurements carried out in an aeroplane up to a height of 9·2 km. show that the no. of large bursts increases more rapidly than the no. of small bursts and that both increase more rapidly than the no. of showers recorded by counters. The results suggest a change in the energy distribution of the electrons with height.　　G. D. P.

Theory of effects of latitude and asymmetry of cosmic radiation. VI. Cones of cosmic rays infinitely near the equator. VII. Trajectories near the equator. Y. L. TCHANG (Ann. Soc. Sci. Bruxelles, 1939, [i], **59**, 285—300, 301—345).　　F. L. U.

Analysis of the latitude effect of cosmic rays in the stratosphere. S. N. VERNOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 140—142).— A discussion of the distribution, absorption, and composition of cosmic rays in the stratosphere.　　J. A. K.

Cosmic rays on the Pacific Ocean. P. S. GILL (Physical Rev., 1939, [ii], **55**, 1151—1159).—A continuation of records previously reported (cf. Compton, A., 1938, I, 9). An atm. temp. coeff. is found to be a function of latitude. There is also a latitude effect, of magnetic origin alone, showing a sharp inflexion at critical N. and S. latitudes, and this inflexion is regarded as associated with the min. energy required for a primary electron to produce mesotrons capable of traversing the atm. The small magnitude of the latitude effect is strong evidence of the secondary nature of mesotrons.　　N. M. B.

Study of cosmic rays in the stratosphere in the vicinity of the magnetic equator. S. N. VERNOV and A. V. MIRONOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 137—139).—The altitude distribution of cosmic rays has been studied by recording radio signals automatically transmitted from the impulses of a Geiger counter in a balloon. The energy spectrum of cosmic particles deduced from the results can be interpreted by assuming that in any latitude all particles with energy > the limiting energy for the vertical distance are present.　　J. A. K.

Anomalies in the directional intensity distribution of cosmic rays. H. S. RIBNER (Physical Rev., 1939, [ii], **55**, 1271).—An east–west directional intensity survey with apparatus of improved angular resolution confirms the existence of an anomalous directional intensity pattern in the sky, and an analysis of such patterns provides highly refined data on primary rays, their spectra, and their behaviour under absorption.　　N. M. B.

Fine structure in the zenith angle distribution of cosmic rays. D. M. COOPER (Physical Rev., 1939, [ii], **55**, 1272; cf. preceding abstract).—Investigations in the eastern azimuthal plane show small deviations of the experimentally observed intensity from the $\cos^2 \theta$ curve as a function of the zenith angle θ.　　N. M. B.

Zenith angle distribution of the hard component of cosmic rays and the mass of the mesotron. P. WEISZ (Physical Rev., 1939, [ii], **55**, 1266—1267; cf. A., 1939, I, 236).—Mathematical.　　N. M. B.

Variations of cosmic-ray intensity with variations of atmospheric pressure and temperature at sea-level. J. CLAY and E. M. BRUINS (Physica, 1939, **6**, 628—632).—Measurements with an A ionisation chamber under 12 cm. of Fe show a daily variation of intensity (I) during the winter, in approx. parallelism with temp., and an antiparallel variation of I with mean temp. over longer periods. Instruments under 110 cm. of Fe record the latter variation, but not the daily changes. The barometric and temp. coeffs. of I for both sets of instruments are $-6·4\%$

per cm. and −0·21% per °c.; the high barometric coeff. is probably related to the large vals. obtained with rays at large angles with the vertical. A. J. E. W.

Decay of penetrating cosmic radiation in different directions. J. Clay, K. H. J. Jonker, and J. T. Wiersma (Physica, 1939, 6, 648).—A correction (cf. A., 1939, I, 175). The % of secondary rays in different directions is nearly const., and the particles decay with a mean life-time between 1·7 and 2·0 × 10⁻⁶ sec. A. J. E. W.

Absorption of hard cosmic rays in different materials. J. Clay and A. G. M. van Gemert (Physica, 1939, 6, 649—655).—Data are recorded for the absorption of the penetrating rays in H_2O, slate (cf. A., 1939, I, 175), Fe, and Pb for 16° cones at different angles with the vertical. Equiv. absorption occurs in 1, 0·82, and 5·7 m. of Fe, Pb, and H_2O, respectively. The absorption is not $\propto d$, and also increases less rapidly than the electron density. The % of secondary rays in different directions is approx. const., but penetrating rays at 60° to the vertical have a high barometric coeff. (~6% per cm.) and penetrate 30 cm. of Pb with very little absorption. A. J. E. W.

Ionisation by cosmic rays in gases. J. Clay and H. J. Stammer (Physica, 1939, 6, 663—672).—Cosmic-ray ionisation in N_2, A, Kr, and Xe (at ≯50 atm.) has been measured between concentric cylinders, using fields of 50—500 v. per cm. Saturation vals. are calc. by the Jaffé–Zanstra formula, and the wall effects are evaluated. The relative ionisation (I) vals. at 1 atm. under 12 cm. of Fe at sea level are N_2 1·00, A 1·65, Kr 4·69, Xe ~7·4. For each gas $I = cp$ or $a + bp$, according as p is < or > the crit. pressure for the vessel. I increases more rapidly than d for the four gases. Comparison is made with data for γ-ray ionisation. A. J. E. W.

Expanded shower of cosmic rays in air. H. Euler and H. Wergeland (Naturwiss., 1939, 27, 484—485).—The formation of expanded showers in cosmic radiation is discussed. The extent of the expansion is independent of the energy of the originating particles and of the no. of particles in the shower. Equations are given which govern the density distribution in the shower. These enable the relative co-incidence frequency of two counter-tubes to be calc. as a function of their distance apart. The calc. frequency is compared with that observed. A. J. M.

Comparison of cosmic-ray showers underground and at sea level. D. H. Follett (Proc. Physical Soc., 1939, 51, 585—591).—A comparison of counter measurements of cosmic-ray shower frequencies from various thicknesses of Pb at sea level and at a depth of 30 m. in clay indicates that results at sea level accord with the predictions of the cascade theory and that those underground, though less unequivocal, can, after corrections and allowances, be similarly explained without the assumption of any special mechanism. N. M. B.

Shower of heavy particles. A. Shdanov (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 28—30).—Nuclear disintegration effected by cosmic rays in a Wilson cloud chamber has been observed. In an experiment at a height of 9000 m. a disintegration was observed in the form of a heavy particle shower with ~100 particles. A photograph of the shower is given and discussed. A. J. M.

Efficiency of electron counters. J. de Vries and G. J. Sizoo (Physica, 1939, 6, 593—598; cf. A., 1939, I, 170).—Two counters are arranged so that electrons pass successively through both; the ratio of the no. of coincidences to the no. of counts in the second counter represents the efficiency of the first counter. The efficiency of an air-filled counter (6—10 cm. pressure) for electrons with $H\rho$ vals. of 1000—8400 gauss-cm. is $1 - e^{\sigma n}$, where n is the mean no. of ions produced per electron, and σ is the probability that a primary ion causes a discharge. Using vals. of n obtained with a Wilson chamber, it is deduced that σ is nearly const. (0·44) for the conditions studied. A. J. E. W.

Electronic field emission obtained during bombardment of aluminium oxide by electrons or negative ions. A. Bojinesco (Compt. rend., 1939, 208, 1800—1802).—Bombardment of a surface layer of Al_2O_3 on Al with electrons and negative ions induces strong electronic emission, detected by a positively charged collector, which continues after bombardment has ceased (cf. Malter, A., 1936, 540). With high collector potentials, scintillations appear on the Al_2O_3 surface. The effect is due to the development in the Al_2O_3 layer of a high potential gradient (~7 Mv. per cm.), which drags the conductivity electrons from the Al support with sufficient velocity to penetrate the surface. A. J. E. W.

Structure of ¹⁵N. G. Beck (J. Phys. Radium, 1939, [vii], 10, 291—293).—Mathematical. From consideration of known data on the behaviour of ¹⁵N, the order of magnitude of the vals. characteristic of the spectrum of the nuclear levels has been estimated. The data indicate that the distribution of levels is not uniform. W. R. A.

Limits of application of metric geometry to nuclear physics. I. J. Mariani (J. Phys. Radium, 1939, [vii], 10, 296—306).—Mathematical. W. R. A.

Indiscernibility of corpuscles. P. Février (J. Phys. Radium, 1939, [vii], 10, 307—323).—Theoretical. W. R. A.

Ionisation in the troposphere. S. Ziemecki (Nature, 1939, 143, 979—980).—Results obtained in three balloon flights indicate that the oscillations of ionisation observed by Suckstorff (Physikal. Z., 1934, 35, 368) in the higher troposphere are due to instrumental errors rather than to radioactive substances of extra-terrestrial origin. The anomalies observed by Juilfs (A., 1939, I, 54) for the lower troposphere are probably due to radioactive substances of terrestrial origin. L. S. T.

Binding energy of ⁶He and nuclear forces. H. Margenau (Physical Rev., 1939, [ii], 55, 1173—1175).—A second-order perturbation calculation of the energy difference ⁶He − ⁶Li, with inclusion of all doubly excited oscillator states, alters the difference only slightly and conserves agreement with experiment (cf.

Feenberg, A., 1937, I, 109), but improves the first-order energy by $\sim$100%. Certain conclusions on the detailed nature of the spin forces are discussed.   N. M. B.

Deviation from the Coulomb law for the proton. H. Fröhlich, W. Heitler, and B. Kahn (Proc. Roy. Soc., 1939, **A**, **171**, 269—280).—A mathematical investigation shows that the force between a proton and a negative point charge becomes repulsive at distances $< \frac{1}{8}$ of the electronic radius. The result arises from the fact that the proton spends a certain fraction of its life in a dissociated state as a neutron and a positive mesotron. It is suggested that the calc. deviation explains recent experiments on the fine structure of the D_a and H_a lines of the H spectrum (cf. Williams, A., 1939, I, 1).   G. D. P.

Transmutation function for deuterons. P. L. Kapur (Indian J. Physics, 1939, **13**, 87—90; cf. A., 1938, I, 293).—For nuclear reactions involving deuterons of which only the neutron is captured it has been shown mathematically that the concept of the " partial entry " of the deuterons into the coulombic potential barrier of the bombarded nuclei has limited validity. This limit is calc. in terms of the author's previously published theory. Graphs are given showing the way in which the total energy of the outgoing proton varies with that of the bombarding deuteron for a no. of vals. of the potential barrier.   T. H. G.

Polarisabilities and van der Waals forces for atoms in S states. J. K. Knipp (Physical Rev., 1939, [ii], **55**, 1244—1254).—Mathematical. Using the Hartree–Fock model, the Møller–Plesset perturbation scheme (cf. A., 1934, 1285) is extended. The approx. vals. found for the at. polarisability of Be and A are 4.14×10^{-24} and 1.28×10^{-24} c.c., respectively. The const. μ in the van der Waals energy, $-\mu/R^6$, is $\sim$222 $\times 10^{-60}$ for two Be atoms and 63.7×10^{-60} erg per cm.^{6} for two A atoms. The observed at. polarisability of A is 1.63×10^{-24} c.c.   N. M. B.

Classical dynamics of the meson. D. Ivanenko (Nature, 1939, **144**, 77—78).   L. S. T.

Instability of the mesotron and the gravitational constant. P. M. S. Blackett (Nature, 1939, **144**, 30).—If the observed lifetime of a mesotron is to be related to other fundamental consts., g must be included. This has been done, and the result indicates the possibility that the decay of the mesotron provides a link between at. and gravitational phenomena.   L. S. T.

Can technical use be made of the energy of the atomic nucleus ? S. Flügge (Naturwiss., 1939, **27**, 402—410).—The energy liberated in nuclear reactions is considered, and the production of a U machine is discussed. It is concluded that an " explosion " in nature is improbable. The applications of the energetics of nuclear reactions to geology are discussed.   A. J. M.

Meson theory of nuclear forces. H. A. Bethe (Physical Rev., 1939, [ii], **55**, 1261—1263).—A comparative examination of the assumption that heavy particles can interact (*a*) only with neutral mesons or (*b*) with charged as well as neutral mesons, by consideration of spin-dependent and spin-independent forces. Calculations for the ground state of the deuteron favour (*a*).   N. M. B.

Conservation of momentum in electrical conductivity. W. V. Houston (Physical Rev., 1939, [ii], **55**, 1255—1261).—Mathematical.   N. M. B.

Theory of the magnetic moment of the proton. J. Solomon (Compt. rend., 1939, **208**, 1795—1797).—The discrepancy in the moment vals. obtained by Rabi (A., 1936, 1316) and Stern (A., 1937, I, 592) is accounted for by considering the virtual emission and absorption of mesotrons by the proton.   A. J. E. W.

Nuclear magnetic moments of ^{14}N, ^{23}Na, ^{39}K, and ^{133}Cs. P. Kusch, S. Millman, and I. I. Rabi (Physical Rev., 1939, [ii], **55**, 1176—1181; cf. A., 1939, I, 56).—Vals. measured by the mol. beam magnetic resonance method are 0.402, 2.216, 0.391, and 2.572 nuclear magnetons, respectively. Results agree fairly well, in the case of the alkali nuclei, with the vals. calc. from the observed hyperfine splitting of at. energy states by the Goudsmit–Fermi–Segrè formula. The shape of the resonance curve indicates in some cases a type of interaction of the nucleus with the rest of the mol. which may arise from the nuclear electric quadrupole moment.   N. M. B.

Electric quadrupole moment of the iodine nucleus. T. Schmid (Z. Physik, 1939, **113**, 140).—A correction of Murakawa (cf. A., 1939, I, 290).   L. G. G.

Coulomb energies and nuclear models. H. Brown and D. R. Inglis (Physical Rev., 1939, [ii], **55**, 1182—1183).—Electrostatic energy differences of isobaric light nuclei, estimated by use of the α-model, do not agree with experiment as well as those given by Bethe (cf. A., 1938, I, 596) for the central model. The comparison with experiment of the binding energies of alphas in the light $4n$-particle in the α-model (cf. Hafstad, A., 1939, I, 6) is improved by inclusion of the Coulomb energy.   N. M. B.

Nuclear isomerism. S. Flügge (Naturwiss., 1939, **27**, 470—471).—Theoretical. Weizsäcker's formula for radiation probability leads to a numerical expression for the half-life period of a γ-transition, which is applied to the calculation of the nuclear radii of ^{80}Br, Ma, and ^{104}Rh.   A. J. M.

Contribution of oscillation binding to the nuclear excitation energy. K. Umeda (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 57—71).—Mathematical.   W. R. A.

Spectral distribution of the light diffused by the photographic image in the ultra-violet. C. Jausseran (Compt. rend., 1939, **209**, 37—39).—The spectral distribution of light diffused by a developed photographic image has been studied by photographing the diffused light for different angles of diffusion. For acute angles the λ of the max. intensity increases with the angle; for obtuse angles the proportion of diffused light decreases rapidly towards 3200 A., then remains approx. const. The displacement of the λ of the light as a function of the angle of diffusion can be attributed to the influence of the multiple reflexions of a ray in the course of its passage through the

photographic image. This effect is further complicated by diffraction due to the fineness of the Ag grains. W. R. A.

Explanation of intensity distribution in the spectrum of aluminium. H. SCHÜLER, H. GOLLNOW, and H. HABER (Naturwiss., 1939, 27, 420—421). —Evidence against the formation of AlH in the gas space in the thermal excitation of the Al spectrum is given (A., 1939, I, 177; Stenvinkel, ibid., 401). It is considered that the phenomenon is one of mol. formation at the surface of the cathode in the sputtering-vaporisation process. The work of Stenvinkel cannot be directly applied to the present conditions owing to different experimental arrangements. A. J. M.

Penetration of the potential barrier and formation of AlH. G. STENVINKEL (Nature, 1939, 143, 854—855).—Enhanced intensities of certain emission lines obtained from Al in H_2 in an electric furnace show that a considerable new formation of AlH mols. takes place in certain states, and demonstrate mol. formation by the H atom penetrating the potential barrier. L. S. T.

CN and AlO bands in the study of the carbon arc. N. R. TAWDE and S. A. TRIVEDI (Proc. Physical Soc., 1939, 51, 733—740).—The simultaneous excitation of two band systems in the same source was investigated by measuring the gross intensity distribution in the AlO blue-green and CN violet systems in the C arc, and results are applied to the interpretation of the relation between the vibration temp. and rotation temp. in this source. The ratios of the excitation temp. of the CN system to those of the AlO system measured simultaneously in the same source are compared with available corresponding ratios for C_2 to CH. Results indicate that as long as the mols. remain the same, the ratio of their temp. remains practically const., irrespective of the conditions. N. M. B.

Completion of term system for carbon monoxide. III. L. GERÖ and R. SCHMID (Z. Physik, 1939, 112, 676—680; cf. A., 1937, I, 279, 442).— The vibration and rotation levels of the $d^3\pi$ and $a^3\pi$ states which explain the perturbations of the various CO bands are given. L. G. G.

Spectra of molybdenum chlorides. P. MESNAGE (Compt. rend., 1939, 208, 1721—1723).—The emission spectrum of a high-frequency discharge in $MoCl_3$ vapour contains arc lines of Mo and diffuse $MoCl_3$ bands with max. at 6400, 6000, 5300, and 4500 A. $MoCl_5$ gives two absorption spectra : A (100—200°) has max. at 4650, 3300, and 2800, and a continuum at <2200 A.; B (~300°, or at lower temp. with high v.p.) has max. at 4550, 3700, and 2900, and a continuum at <2300 A. The v.d. at 350° corresponds with $MoCl_5$ mols., and the A-spectrum is probably due to a polymerised form. A. J. E. W.

Ultra-violet absorption of solid polymorphic substances. A. BERTON (Compt. rend., 1939, 208, 1898—1900; cf. A., 1938, I, 433).—The polymorphic form of an org. or inorg. compound which has its absorption limit at the highest λ has also the lowest d and thermal stability and the highest solubility and reactivity. This generalisation is illus-

trated by data for anthracene and dianthracene, MeCHO and its polymerides, ZnS, As_2O_3, Sb_2O_3, Bi_2O_3, and TiO_2. Thermal expansion of a solid increases its absorption at higher λλ. A. J. E. W.

Absorption spectra and optical electrons of tervalent ions of the rare earths. V. DOLEJŠEK and C. ŽADKEVIČ (Coll. Czech. Chem. Comm., 1939, 11, 196—210).—From a study of aq.-org. solutions of Pr and Nd salts it has been shown that if the dipole moment of the solvent diminishes, the absorption bands of the cations increase and are displaced towards longer λλ, the amount of displacement being of the same order for all the bands. Basing an explanation on Scheibe's theory, it is shown that the optical electrons are in the interior of the ion and are thus protected against external influences, with the result that the chromophores are only slightly deformable. C. R. H.

Fluorescence of carbonyl compounds in the gas phase. M. S. MATHESON and J. W. ZABOR (J. Chem. Physics, 1939, 7, 536—538).—The fluorescence spectra of the homologous CO compounds Ac_2, $COMe_2$, COMeEt, MeCHO, $COEt_2$, and EtCHO have been photographed. The fluorescence of the first four compounds consists of three bands at ~5100, 5600, and 6100 A. Fine structure is observed for Ac_2 and MeCHO similar to that reported by Padmanabhan for $COMe_2$ (cf. A., 1937, I, 494). For $COMe_2$ the intensity of the fluorescence becomes weaker with increasing temp. (25—65°). Ac_2 fluorescence also weakens with increasing temp., but < that of $COMe_2$. The data suggest that the fluorescence of these four compounds is due to Ac_2. The fluorescence spectra of $COEt_2$ and EtCHO are similar in all respects with a strong max. at ~5200 A. This fluorescence, by analogy, is probably due to $(COEt)_2$. W. R. A.

Ultra-violet absorption spectra of 1 : 3-cyclohexadiene. V. HENRI and (Miss) L. W. PICKETT (J. Chem. Physics, 1939, 7, 439—440).—$\Delta^{1:3}$-cycloHexadiene (I) vapour shows an intense absorption band in the region 35,000 to 45,000 cm.$^{-1}$ with 5 max. falling into three groups. In C_6H_{14} solution the band has three max. The vapour of the C_6H_{14} solution of (I) gives bands identical with those of pure vapour of (I). Vals. of oscillator strength have been obtained in good agreement with theoretical predictions using Mulliken's f val. Correction of the f val. for Lorenz-Lorentz forces in the solution vitiates the agreement. W. R. A.

Absorption spectrum of thiophen and its homologues. P. BARCHEWITZ and J. GARACH (Compt. rend., 1939, 208, 2071—2072).—The absorption spectrum (0·6—1 μ.) of thiophen (I) contains two pairs of bands (8665, 8594; 7087, 6995 A.), corresponding with the third and fourth harmonics of the fundamental CH bands; the absence of a band at ~0·97 μ. shows that the mol. contains no ethylenic linking. The shorter-λ component of the CH bands has a lower intensity with 2-methylthiophen, and disappears with 2 : 5-dimethylthiophen; β-substitution has a similar effect on the longer-λ component. The two components are thus due to the α- and β-CH oscillators, which differ owing to the effect of the S atom. Substitution by Me displaces the CH bands to higher λλ.

These bands occur at shorter $\lambda\lambda$ than in C_6H_6 owing to ring strain and the unsaturation of (I). Thionaphthen gives CH bands due to both nuclei. Allyl sulphide gives a more complex spectrum, containing the ethylenic linking band at 0.9704μ. A. J. E. W.

Chelate structure of *oo'*-di[hydr]oxyazobenzene in solution. H. Shingu (Nature, 1939, **143**, 1068—1069).—The absorption curves for *oo'*-dihydroxyazobenzene (I) and *o'*-anisoleazo-*p*-cresol in EtOH are practically identical, but in CCl_4 they show differences, indicating that the chelate structure of (I) is somewhat mobile in comparison with that of *o*-monohydroxyazocompounds, and that it undergoes with relatively small activation energy a reversible change which is the cause of its enhanced acidity and its marked tendency to form metallic lakes. L. S. T.

Arrangement of electronic bands in spectra of solutions. II. Absorption of aliphatic nitrocompounds and oximes. G. Kortüm (Z. physikal. Chem., 1939, **B**, **43**, 271—291).—An extension of previous work (A., 1939, I, 178) to aliphatic NO_2-compounds and oximes. W. R. A.

Absorption spectra and structure of compounds containing chains of benzene nuclei. A. E. Gillam and D. H. Hey (J.C.S., 1939, 1170—1177).—Although chemical tests fail to indicate conjugation of the aryl nuclei in Ph_2 and its derivatives, and so lead to the conclusion that the internuclear link is an invariable single bond uniting two *cyclo*hexatriene rings, dipole moment and X-ray studies suggest that it does possess a measure of double-bond character. Further evidence of internuclear conjugation is provided by an examination of the absorption spectra of di-, *p*-ter-, *p*-quater-, *p*-quinqui-, and *p*-sexi-phenyl. These show gradual displacement of the principal absorption band towards longer λ as the no. of *p*-substituted C_6H_6 nuclei increases. However, with *m*-$C_6H_4Ph_2$ and the series of hydrocarbons containing from 9 to 16 C_6H_6 nuclei linked in the *m*-positions, all the compounds show the same band (at 2530 A. in $CHCl_3$) but this increases in intensity with the no. of nuclei. It follows, therefore, that in the *p*-series a measure of conjugation occurs throughout the whole mol., whilst in the *m*-series, since the structure prevents conjugation extending beyond two C_6H_6 units, the conjugation which gives rise to the absorption spectra is identical with that due to Ph_2 itself. It is shown that the chromophoric unit in both series is half a Ph_2 mol., not a C_6H_6 mol. T. H. G.

Light absorption of organic compounds and the nature of unsaturated linkages. A. Burawoy (J.C.S., 1939, 1177—1188).—It is shown that a chromophore is an atom or group which is responsible for the appearance of a certain absorption band in contrast to the various substituents which displace it. Auxochromic groups, the effects of which are described in detail, are the terminal groups of chromophores. The light absorption of org. compounds may be due to either (or, separately, to both) of two different types of chromophoric groups. These are (i) "multiple" linkages E:E' actually existing in the radical state E·E', and the unsaturated atoms of free radicals, such as the C of CPh_3 and (ii) all types of conjugated

systems. It is shown that compounds containing multiple linkages represent equilibria between electron-isomeric mols., *i.e.*, mols. which have the same at. but different electronic structures. T. H. G.

Spectrographic examination of flavone pigments.—See A., 1939, II, 385.

Absorption spectra of proteins. E. Holiday (Nature, 1939, **143**, 895—896).—A criticism (cf. A., 1939, III, 420). L. S. T.

Infra-red absorption spectrum of liquid hydrazine. S. S. Krivitsch (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 36—38).—The absorption spectrum of liquid N_2H_4 has been investigated over the range 1—14 μ. The absorption is very strong, intense bands occurring at $11.3, 9.1, 6.2$, and about 3.1μ., the last of which has two max. at 3.06 and 3.13μ. Weak bands also occur at $7.55, 2.0—2.35$ (max. at $2.07, 2.17, 2.28$), and 1.57μ. Comparison with the Raman spectrum shows agreement between a no. of the lines. There is also some approximation to lines in the NH_3 spectrum. The investigation confirms the asymmetry of the N_2H_4 mol. A. J. M.

Spectrum of hydrogen chloride in the photographic infra-red. E. Lindholm (Naturwiss., 1939, **27**, 470).—The 4–0 and 5–0 bands of HCl at 9152 and 7463 A. have been photographed. The ν_0 vals. are 10923.14 and 13396.5 cm.$^{-1}$, respectively. The cubic term in the nuclear vibration formula can be calc. from these vals. The intensity of the bands is small. A. J. M.

Infra-red absorption spectrum of boron trifluoride. D. M. Gage and E. F. Barker (J. Chem. Physics, 1939, **7**, 455—459).—The infra-red absorption spectrum of BF_3 from 400 to 3000 cm.$^{-1}$ consists of 7 bands, which are discussed. Three active fundamentals, each exhibiting an isotope effect, have been observed. One of them, ν_2, is a parallel band which has been partly resolved and yields 79×10^{-40} g. cm.^{2} for the moment of inertia and 1.29 A. for the B—F distance. W. R. A.

Vibration rotation bands of some polyatomic molecules in the photographic infra-red. H. W. Thompson (J. Chem. Physics, 1939, **7**, 441—447).—Infra-red absorption spectra have been measured from 7000 to 12,000 A. for MeSH, NH_2·OMe, MeO·NO, AcOH, Me_2O, MeF, MeCl, MeBr, and MeI and the bands are analysed and discussed. For MeF a moment of inertia of 33.7×10^{-40} g. cm.^{2} is deduced from a parallel band. W. R. A.

Infra-red spectrum of methylamine. H. W. Thompson (J. Chem. Physics, 1939, **7**, 448—452).—Using low dispersion the spectrum of NH_2Me has been investigated from 7000 to 12,000 A.; it comprises five bands, of which the most intense is at 10,310 A., and that at 9950 A. has a doublet structure. The 9950 A. band, examined under high dispersion, is of the perpendicular type and yields C—N ~1.47 A., N—H ~1.02 A., angle CNH $\sim108°$. Vibrational assignments have been made. No evidence of internal rotation has been found. W. R. A.

Transmission of several nitriles in the far infra-red. P. Barchewitz and M. Parodi (Compt.

rend., 1939, **209**, 30—31).—The transmission of PhCN, CHCl$_2$·CN, EtCN, PrCN, and MeCN has been studied from 180 to 550 cm.$^{-1}$ All the compounds give one absorption band (A) of ν between 369 and 390 cm.$^{-1}$, and another of 244—283 cm.$^{-1}$ That (A) is due to a deformation vibration of the C:N linking is supported by the fact that the corresponding ν, active in the Raman spectra, has been observed for the majority of the compounds. The bands at ν <350 cm.$^{-1}$ observed with MeCN and MeI are attributed to the rotation of the Me group about the axis of symmetry of the mol. (ν = 10·2m, where m is an integer). W. R. A.

Infra-red band of formic acid at 7525 A. H. W. THOMPSON (J. Chem. Physics, 1939, **7**, 453—455).—HCO$_2$H vapour at 100° gives a weak band at 7525 A. which is the fourth harmonic of the O–H vibration band. Its structure is similar to that of the third harmonic at 9801 A. (A., 1938, I, 60) and is a hybrid band with the perpendicular type component the more intense. From the measured rotational structure the moment of inertia is 10·83 × 10^{-40} g. cm.^{2} W. R. A.

Vibration spectra and molecular structure. VII. Further infra-red studies on the vapours of some carboxylic acids. R. C. HERMANN and R. HOFSTADTER (J. Chem. Physics, 1939, **7**, 460—464).—Spectra of the vapours of CD$_3$·CO$_2$D, CD$_3$·CO$_2$H, EtCO$_2$H, and EtCO$_2$D have been investigated from 1 to 16 μ. and bands, assignable to monomeric and dimeric forms, are discussed. The heat of association of EtCO$_2$D is 14,080±500 g.-cal. per mol. W. R. A.

Infra-red spectrum of ascorbic acid. E. HEINTZ (Compt. rend., 1939, **208**, 1893—1896).—Absorption curves (1—14 μ.) for a solid film and 0·1 and 0·4M-ascorbic acid (I) in a KH$_2$PO$_4$–H$_3$PO$_4$ buffer (p_H 2·71) are given. The bands are classified into groups due to >C<, C:C, C:O, and OH; bands corresponding with the measured p_K vals. (cf. A., 1935, 444; 1936, 1069) are also observed. 0·1M-(I) gives additional bands at 2·3 and 4·5—4·6 μ., which are ascribed to CO and OH groups. The occurrence of these bands and the oxidation–reduction potential variations in (I) solutions (cf. A., 1938, I, 460; 1939, III, 538) suggest that a free-CO$_2$H form of (I) is obtained by hydration in dil. solutions (cf. A., 1934, 511). A. J. E. W.

Infra-red absorption spectra of the xylidines and the phenomenon of steric hindrance. Y. TA (Compt. rend., 1939, **208**, 1993—1995).—The absorption spectra of m-2-, m-5-, m-4-, and p-xylidine at 7000—5500 cm.$^{-1}$, containing the first harmonics of the aromatic CH, Me, and NH$_2$ bands, are studied. The aspect of the CH band differs with each isomeride. With the m-2-compound the NH$_2$ band is particularly intense, and undergoes a larger displacement towards higher νν on dilution with CCl$_4$; the aspect of the Me band is also abnormal with this isomeride. The differences are attributed to the effect of steric hindrance on association, which is marked with the m-2-compound. A. J. E. W.

Absorption of some naphthalene derivatives in the very near infra-red. P. BARCHEWITZ (Compt. rend., 1939, **208**, 1991—1993).—The absorption spectrum of C$_{10}$H$_8$ (in CCl$_4$) at 0·6—1 μ. contains the third harmonic of the 3·3 μ. CH band (8775 A.), which has a simple structure. Mono- and di-substitution by Me causes displacement of this band to higher λλ, the Me groups being electropositive with respect to the C$_{10}$H$_7$ radical; with isomerides the displacement increases with the symmetry of the mol. The Me group gives a triple band with intense components at 9110 and 9210 A. The CH displacements with α- and β-C$_{10}$H$_7$·NH$_2$ and -C$_{10}$H$_7$·OH [which give strong OH bands at 9738 (α) and 9722 A. (β)] are too small to be measured. α-substitution by Cl or NO$_2$, giving a linking with a negative moment, causes a CH displacement to lower λλ (8765, 8728 A.). A. J. E. W.

Study of cadmium bromide solutions by the Raman effect. Complete Raman spectrum of the cadmitetrabromide [ion]. (MLLE.) M. L. DELWAULLE, F. FRANÇOIS, and J. WIEMANN (Compt. rend., 1939, **208**, 1818—1820; cf. A., 1939, I, 143).—Conc. aq. CdBr$_2$ (with and without added alkali bromide) and solutions of CdBr$_2$ and LiBr in MeOH and octyl alcohol give four Raman lines [53, 62, 181 (depolarised); 166 cm.$^{-1}$ (almost completely polarised)], which are attributed to the tetrahedral [CdBr$_4$]″ ion. Comparison is made with data for [CdI$_4$]″ and analogous Sn ions. A. J. E. W.

Raman spectrum of the trimeric phosphonitrile chloride molecule, (PNCl$_2$)$_3$. A. M. DE FICQUELMONT, M. MAGAT, and (MLLE.) L. OCHS (Compt. rend., 1939, **208**, 1900—1903).—CCl$_4$ and CS$_2$ solutions of (PNCl$_2$)$_3$ give 15 Raman lines (100—1230 cm.$^{-1}$), of which four are polarised and four depolarised; the remainder are of low intensity, and probably depolarised. It is deduced that the symmetry of the mol. is D_{3h}, other classes being excluded by the Raman, X-ray, and chemical evidence. A. J. E. W.

Raman spectrum of antimony trimethyl. E. J. ROSENBAUM and T. A. ASHFORD (J. Chem. Physics, 1939, **7**, 554).—The νν of 7 Raman displacements of SbMe$_3$ obtained with an exposure of ∼8 hr. and unfiltered Hg radiation are given. W. R. A.

Raman effect of fluorochloromethane. G. GLOCKLER and J. H. BACHMANN (Physical Rev., 1939, [ii], **55**, 1273; cf. A., 1939, I, 300).—Data for 9 Raman shifts at −30° are reported. N. M. B.

Raman effect of difluorodibromomethane and chlorodibromomethane. G. GLOCKLER and G. R. LEADER (J. Chem. Physics, 1939, **7**, 553).—Both compounds show 9 Raman displacements. CF$_2$Br$_2$ showed no perceptible photochemical decomp. when exposed cold to NaNO$_2$-filtered Hg radiation. Uncooled CHClBr$_2$ decomposes slightly under unfiltered Hg radiation. W. R. A.

Raman effect. XCIX. Esters of mono- and poly-carboxylic acids. K. W. F. KOHLRAUSCH and R. SABATHY (Monatsh., 1939, **72**, 303—310).—Data are recorded for the Raman spectra of ClCO$_2$R (R = Pr^β, Bu^α, CH$_2$Bu^α, CCl$_3$), CO(OR)$_2$ (R = Pr^α, Pr^β, Bu^α, CH$_2$Bu^α), CHBu^γ(CO$_2$Et)$_2$,

$(CO_2Et)_2CH\cdot[CH_2]_n\cdot CH(CO_2Et)_2$ ($n = 0$, 1, 2, 3), Et_2 cyclobutane-1 : 1 : 2 : 2-tetracarboxylate, and $Pr^a CO_2 Pr^\beta$. The CO-frequency is lower in the $ClCO_2R$ than in the corresponding $ClCO\cdot CH_2R$, but higher in $CO(OR)_2$ than in $CO(CH_2R)_2$, and in ROAc than in CH_2RAc; between HCO_2R and $HCO\cdot CH_2R$ the difference is negligible. The acid chlorides show additional lines between 500 and 600 cm.[-1] The effects are attributable to resonance in $ClCO_2R$ giving a partial double bond character to the C·OR linking. L. J. J.

Raman spectra and structure of amides. C. SANNIÉ and V. POREMSKI (Compt. rend., 1939, **208**, 2073—2075).—The Raman spectra of NH_2Ac, NHAcEt, $NAcEt_2$, and $NH\colon CEt_2$ have been studied with the pure compounds and solutions in various solvents. The nature of the solvent has little effect on lines at <1500 cm.[-1], but pronounced differences occur at 1500—1750 cm.[-1], indicating the existence of four forms of the amides, for which characteristic Raman ѵѵ are given. A resonance form (cf. A., 1935, 283; 1936, 922) predominates in the pure state and in solution in H_2O and non-polar solvents. Aq. solutions contain an imino-alcohol form, which also occurs to a very small extent in the pure amide, and an association complex (3 mols.). HCl solutions contain an excited form. The true amide form exists only in dioxan solutions of NH_2Ac and in pure $EtCO\cdot NH_2$. The C:N linking occurs in nearly all cases. A. J. E. W.

Raman spectra of some oximes. (MLLE.) D. BIQUARD (Bull. Soc. chim., 1939, [v], **6**, 1230—1233).—Data are recorded for $CMe_2Bu\cdot CPh\colon N\cdot OH$, $CPhMe\colon N\cdot OH$, α-$CHPh\colon N\cdot OH$, $CMePr^a\colon N\cdot OH$, $CMePr^\beta\colon N\cdot OH$, and $CEt_2\colon N\cdot OH$. J. W. S.

Rigidity of liquids. (SIR) C. V. RAMAN and C. S. VENKATESWARAN (Nature, 1939, **143**, 798—799; cf. A., 1939, I, 9).—Spectra of the scattering of the Hg 4046 A. radiation by C_6H_6, AcOH, salol, and glycerol (I) are reproduced. In the spectrum of (I) the rotational wings accompanying the Rayleigh lines are almost absent, indicating that, in respect of light scattering, (I) is practically indistinguishable from an amorphous solid. The behaviour of ultrasonic waves in viscous liquids suggests that for mechanical disturbances of sufficiently high ѵ, a liquid behaves essentially as a solid. L. S. T.

Raman spectrum of benzene in circularly polarised light. J. CABANNES and P. DAURE (Compt. rend., 1939, **208**, 1700—1702).—The depolarisation of a no. of the Raman lines of liquid C_6H_6 is examined by determination of $r = \rho/(1 - \rho)$ with circularly polarised light, enabling small variations of ρ to be detected. A study of polarisation is essential for the classification of higher-order and combination ѵѵ. The 992 cm.[-1] multiplet is examined, and new components are recorded at 988·4, 990·2, 994·5, 996·2, and 999·6 cm.[-1] ρ measurements confirm that the 984 and 1005 cm.[-1] components are due to $^{12}C_5 {}^{13}CH_6$ (A., 1938, I, 175), and that 1585—606 and 1604—606 cm.[-1] combination ѵѵ occur at 979 and 998 cm.[-1] (A., 1938, I, 296). A. J. E. W.

Raman spectra of pyrone compounds. M. V. VOLKENSCHTEIN and J. K. SIRKIN (J. Phys. Chem. Russ., 1938, **12**, 677—679).—Dimethylpyrone, its hydrochloride and hydrobromide, coumarin and its hydrochloride, coumarone, and xanthone were investigated. J. J. B.

Distribution of fluorescence excitation of bivalent europium in calcium fluoride and of bivalent samarium in calcium sulphate. H. P. ECKSTEIN (Nature, 1939, **143**, 1067; cf. A., 1938, I, 495).—Photographs showing that prolonged irradiation of Sm (in $CaSO_4$) with short-wave ultra-violet radiations produces an effect similar to that obtained with Ra rays are reproduced. L. S. T.

Fluorescence spectra of the rare earths in synthetic fluorites and their explanation. N. CHATTERJEE (Z. Physik, 1939, **113**, 96—114).—The intensities and λλ of the fluorescence spectra, excited by light at 20° and cathode rays at −180°, for CaF_2–Sm, CaF_2–Eu, CaF_2–Tb, CaF_2–Dy, CaF_2–Er, and YF_3–Eu are measured and, for comparison, similar data from the absorption spectrum of CaF_2–Eu are given. Results are explained theoretically and J-terms given. L. G. G.

Influence of the size of phosphorescent crystals on the radius of action of α-particles. J. ALLARD and G. DESTRIAU (J. Chim. phys., 1939, **36**, 161—163; cf. A., 1936, 1320).—Analysis of crystals of phosphorescent ZnS containing Cu shows that the Cu content is independent of size. This confirms the view that the increase in the no. of excited centres observed in the smaller crystals is due to an increase in the radius of action of the α-particles. F. L. U.

Sensitisation of phosphorescent zinc sulphide to the action of red rays. J. SADDY (Compt. rend., 1939, **209**, 93—95).—Fe (0·005%) has a sensitising action on the extinction by red light of the phosphorescence of ZnS (Cu 0·007%). The relative extinguishing effect of the red rays rises to a max. much more rapidly in presence of Fe. A. J. E. W.

Position occupied by the activator in impurity-activated phosphors. H. G. JENKINS, A. H. McKEAG, and H. P. ROOKSBY (Nature, 1939, **143**, 978).—X-Ray examination of impurity phosphors shows lattice changes in Zn Be orthosilicate, $CaWO_4$, and Zn_2SiO_4. In Zn_2SiO_4 activated by different % of Mn, the measured lattice expansion is of the kind to be expected from the replacement of Zn atoms by those of Mn, and the activated phosphor can be regarded as a solid solution of Mn_2SiO_4 and Zn_2SiO_4. A solid solution effect is also shown by $CaWO_4$ activated by ∼3% by wt. of Pb. L. S. T.

Luminescence and photoconductivity of solids. J. T. RANDALL and M. H. F. WILKINS (Nature, 1939, **143**, 978—979).—Measurements on the photoconductivity and phosphorescence decay curves of many luminescent solids afford direct evidence of excitation states in UO_2^{II} salts, in tungstates, and in certain impurity compounds activated by Mn and Cr. UO_2^{II} salts show no photoconductivity, and the exponential phosphorescence decay curves support the view (A., 1939, I, 124) that their luminescence results from the absorption of energy within the co-ordination group

of UO_2". $CaWO_4$, $MgWO_4$, and $ZnWO_4$ show no photoconduction under radiations giving rise to strong fluorescence. Their luminescence is probably similar to that of UO_2,II, and arises from transitions between the excitation states and the ground state of WO_4". Photoconductivity and phosphorescence measurements show that the fluorescence of pure Mn compounds and of solids activated by Mn is frequently due to transitions within Mn" (*ibid.*, 301). Pure $MnCl_2$, and, when activated by Mn, Cd chlorophosphate, borate, and silicate, and Zn mesodisilicate are not photoconducting, and their phosphorescence decay curves are exponential. Pure CaO, and Al_2O_3 with Cr as impurity, are also non-photoconducting. Phosphors that can store luminescent energy at low temp. and release it on warming are photoconducting solids such as willemite and ZnS. Non-photoconducting solids do not show this effect to a marked extent. In the ZnS phosphors it is the long-period phosphorescence that is markedly delayed by cooling.

L. S. T.

Luminescence of wetted solids. J. EWLES (Proc. Leeds Phil. Soc., Sci. Sect., 1939, **3**, 557—558 ; cf. A., 1930, 664).—Many wetted white powders (alkali halides, SiO_2, CaF_2, $CaCO_3$, and filter-paper) show appreciable fluorescence when activated by ultra-violet light. The spectra are apparently identical and consist of four broad bands, with max. at 4625, 5200, 5680, and 6100 A. Experiments indicate that the fluorescence is due to H_2O, which may be included inside the crystal grains or adsorbed on internal cracks.

D. F. R.

Luminescence of water under the action of ultrasonics. P. PAOUNOFF (Compt. rend., 1939, **209**, 33—36).—Under the action of ultrasonics H_2O becomes luminescent only when it contains O_2 or air (experiments with H_2, N_2, and CO_2 were negative). During the luminescence O_2 mols. are converted into O_3. The spectrum of the light contains a wide band from 445 to 558 mµ. which agrees with that of O_3 at the moment of decomp. (460 to 560 mµ.). The intensity of the luminescence increases with the intensity of the ultrasonic excitation.

W. R. A.

Luminescence in electric fields and electronic phenomena in semiconductors. G. DESTRIAU (Compt. rend., 1939, **209**, 36—37).—An extension of work already noted (cf. A., 1939, I, 301).

W. R. A.

Fluorescence and propagation of energy with reversible polymerised dyes. G. SCHEIBE, A. SCHÖNTAG, and F. KATHEDER (Naturwiss., 1939, **27**, 499—501).—A summary of work on absorption and fluorescence of dyes of the ψ-*iso*cyanine class, which exist in polymeric forms, is given. The single mols. of such dyes are held together in the polymeric form by van der Waals forces, the hydrophobic hydrocarbon radicals playing an important part in the linking. Each unit in the polymeric mol. can absorb light, since the oscillator strength of the band due to the polymeride is approx. the same as that of the single mol. In consequence of the coupling of the resonators, light energy can be rapidly propagated through mols. It can pass through 10,000 mols. in $<10^{-8}$ sec. Where any interruption occurs the energy

is converted into heat or chemical energy. Such polymeric mols. are able to give up many quanta to foreign mols. in a short time, so that very short-lived intermediate stages could occur in photochemical reactions in which such mols. are concerned.

A. J. M.

Ultra-violet chemiluminescence. A. GURWITSCH and L. GURWITSCH (Nature, 1939, **143**, 1022—1023).—Experiments showing that the addition of an inert substance, *e.g.*, glucose, to a source of chemiluminescence, *e.g.*, glycine irradiated mitogenetically, introduces new lines into the emission spectrum are described. The new lines are due, presumably, to mols. excited by the energy liberated.

L. S. T.

Electronic conduction in crystals. R. HILSCH (Naturwiss., 1939, **27**, 489—492).—The conductivity of transparent crystals at temp. at which they are no longer insulators in the dark is considered. The mechanism of the production of the photo-electric secondary current is made clear by considering photo-electric semi-conducting crystals. Rectification by semi-conductors and the scattering of electron currents in crystals are also considered.

A. J. M.

Copper–cuprous oxide photo-cells. N. F. MOTT (Proc. Roy. Soc., 1939, A, **171**, 281—285).—The behaviour of $Cu-Cu_2O$ photo-cells is interpreted in terms of a theory of the contact between a metal and a semi-conductor (cf. A., 1939, I, 356).

G. D. P.

Quantum equivalent of the primary current of the inner photo-effect. F. HLUČKA (Z. Physik, 1939, **113**, 56—60).—The spectral yield for diamond, Zn blende, and yellow coloured (X-rays) rock-salt crystals are exemplified in the results for Zn blende in which it is shown that only for a relatively small spectral range at the max. of the current curve is the relation $N = Q/h\nu$ fulfilled ($N =$ no. of electrons released and $Q =$ absorbed energy).

L. G. G.

Selenium photo-elements. II. A. BECKER (Z. Physik, 1939, **112**, 629—647 ; cf. A., 1938, I, 4).—A systematic investigation of the properties of Se photoelements is recorded ; special attention is given to their properties in stationary electric fields, to variations of c.d. with incident light, and to the influence of temp.

H. C. G.

Photo-electric effect and the photoconductivity of phosphorescent sulphides and fluorides. E. VOYATZAKIS (Compt. rend., 1939, **209**, 31—33).—The photo-electric effect of phosphorescent CaS and some fluorides (synthetic and natural) and the photoconductivity of phosphorescent ZnS disappear completely on drying. Phosphorescent ZnS shows only the photoconductivity effect, whilst phosphorescent CaS is photo-electric as well as photo-conductive.

W. R. A.

Temperature characteristics of dielectric losses at high frequencies. T. AKAHIRA, M. KAMAZAWA, and Y. TSUMITA (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 517—528).—The dielectric loss angle, δ, of various insulating materials has been measured from 20° to 300° and from 10^5 to 10^7 cycles. In general δ increases with temp. and the variation of tan δ is more rapid at low frequencies. No change in

tan δ was observed with quartz, mica, and ambroid. Moisture has a large effect on porcelain and bakelite.
D. F. R.

Electrical conductivity of coloured alkali halides. Z. GYULAI (Z. Physik, 1939, **113**, 28—35). —The sp. conductivity of KCl and KBr coloured crystals ∝ voltage, but obedience to Ohm's law is restored by thermal bleaching. Thermally bleached have a lower conductivity than untreated crystals, a phenomenon not observed when the bleaching is done with Br vapour. The variation of conductivity in the coloured crystals is related to the reduced work of release of electrons in electric fields and this is considered in relation to the analogous case of NaCl pastilles containing H_2O vapour.   L. G. G.

Theory of electronic semi-conductors. B. R. A. NIJBOER (Proc. Physical Soc., 1939, **51**, 575—584).— A discussion of the discrepancies between Wilson's theory of semi-conductivity and recent experimental data, and the possibilities of their elimination by an extension of Wilson's theory.   N. M. B.

Measurements on the dielectric constant of carbon dioxide at 25°, 50°, and 100° up to 1700 atmospheres. A. MICHELS and L. KLEEREKOPER (Physica, 1939, **6**, 586—590).—Previous measurements (A., 1933, 447) have been repeated with higher accuracy, and vals. of ε, ρ, and the Clausius–Mosotti function are recorded. The last named function has a broad max. at ρ = ~300 Amagat, and a val. of 7·48 c.c. per g.-mol. at 1 Amagat.   A. J. E. W.

Dielectric constant of benzene. W. C. VAUGHAN (Phil. Mag., 1939, [vii], **27**, 661—668).—Using a method described previously (A., 1939, I, 492). Vals. of ε for C_6H_6 are : 20°, 2·2818 ; 25°, 2·2678.   W. R. A.

Molecular freedom and melting in alkyl halides. W. O. BAKER and C. P. SMYTH (J. Amer. Chem. Soc., 1939, **61**, 1695—1701).—Dielectric const. and apparent conductance of liquid and solid $Pr^\beta Br$ and $n\text{-}C_5H_{11}Br$ have been measured at various temp. and frequency and cryst. phases have been examined with the polarising microscope. For $Pr^\beta Br$ hindered rotational freedom is revealed from the f.p. (—90·8°) to ~—131° and the lattice is anisotropic. $n\text{-}C_5H_{11}Br$ gives a monotropic transition at —88·7°, 5·9° > the f.p., but this does not involve detectable rotational freedom. These and other data yield a correlation of m.p., heats and entropies of fusion, and liquid intervals of alkyl halides with the shapes and mobilities of their mols. in the crystals.   W. R. A.

Dielectric polarisation of solutions of methyl alcohol in 1 : 4-dioxan. Dipole moment of methyl alcohol. J. BENOIT and G. NEY (Compt. rend., 1939, **208**, 1888—1890).—ε and d vals. for solutions with MeOH mol. fractions of 0·038—0·272, at 12—50°, are given, and vals. of P_{12} are deduced. The P_{200} vals. for MeOH (82—74) give a dipole moment of 1·84±0·01 D., which is > the vals. obtained for the vapour or C_6H_6 and CCl_4 solutions.   A. J. E. W.

Dipole moments and molecular structure of methyl and ethyl carbonates. G. THOMSON (J.C.S., 1939, 1118—1123).—Measurements in C_6H_6 solution at 25° show that the dipole moments of Me_2CO_3 and Et_2CO_3 are 1·06 and 0·90 D. respectively

as compared with 0·86—1·00 and 1·06 respectively found by Kubo (A., 1937, I, 445 etc.) for the vapours. It is suggested that Kubo's Me_2CO_3 was impure as it forms an azeotropic mixture with MeOH. The moments of the possible planar models (two for Me_2CO_3 and three for Et_2CO_3) have been calc., allowance being made for induction effects. One model for each gives a moment in close agreement with that observed. In each case the structure is that of a fully extended zig-zag symmetrically disposed with respect to the C:O bond. It is shown, by calculation of the induction effect in Et_2O, that the differences in the moments of Me_2CO_3 and Et_2CO_3 are due to this and not to any change in the valency angle of O, which is taken as 111°.   T. H. G.

Polar effects of alkyl groups. J. W. BAKER (J.C.S., 1939, 1150—1155).—Using the results of Baker and Groves (see below) for the dipole moments of PhMe, PhEt, $PhPr^\beta$, and $PhBu^\gamma$, the resultant polar effects of the primary, sec., and tert. alkyl groups are shown to depend jointly on (i) an inductive and inductomeric effect ($+I$) which increases in the order Me < Et < Pr^β < Bu^γ ; (ii) a tautomeric electron-release (see A., 1936, 195) which decreases in the order Me > Et > Pr^β > Bu^γ ; (iii) a purely spatial effect increasing in the order Me < Et < Pr^β < Bu^γ. (iii) is operative only when the alkyl is situated right at the seat of the reaction, and (ii) is of minor importance only in the ground state ($+M$) of the mol. and in reactions which require the recession of electrons from the reaction centre. It may, however, develop dominating importance ($+E$) in the transition state, in reactions which require electron accession. Adopting the correlation between the electron-release effects of substituents and energy levels which is being proposed by Hughes, Ingold, Masterman, and MacNulty, it is shown that the results of Baker et al. (A., 1936, 195) and of Evans (ibid., 941) on the prototropy of methyleneazomethine systems and of substituted acetophenones can be explained satisfactorily on the basis of the combined polarisation and polarisability effects of the alkyl substituents in the ground and transition states.   T. H. G.

Determination of dipole moments in the vapour phase. II. Moments of alkylbenzenes and alkylcyclohexanes. J. W. BAKER and L. G. GROVES (J.C.S., 1939, 1147—1150).—Using Groves' apparatus (A., 1939, I, 492), the moments of PhMe, PhEt, $PhPr^\beta$, and $PhBu^\gamma$ have been found to be 0·37, 0·58, 0·65, and 0·70 D. respectively. From these results that of $p\text{-}C_6H_4MeBu^\gamma$ (I) should be 0·33 D., in good agreement with the observed val. 0·39 D. As anticipated, the corresponding cyclohexanes have zero moment in the vapour state. The val. for $PhBu^\gamma$ is ≫ that obtained by Le Fèvre, Le Fèvre, and Robertson (A., 1935, 684) from observations in solution but the correlation of the present result with those for PhMe and (I) indicates its reliability and that the special explanation suggested by these authors is not necessary.   T. H. G.

Determination of the adiabatic piezo-optic coefficient of liquids. (SIR C.) V. RAMAN and K. S. VENKATARAMAN (Proc. Roy. Soc., 1939, **A, 171**, 137—147).—The change of refractive index, n, due to

the sudden application of pressure was measured by an interference method. C_6H_6, CS_2, $CHCl_3$, Et_2O, MeOH, and H_2O were investigated. The results are discussed with reference to (1) the Lorentz refraction formula, (2) the variation of n with temp. at const. density, and (3) the relation between adiabatic and isothermal piezo-optic consts. G. D. P.

Microscopic examination of gratings with irregularities. H. SIEDENTOPF (Z. Physik, 1939, **112**, 704—726).—The observation of grating-like objects having divisions near the limit of resolution of the microscope is discussed with regard to the mutual interference of diffraction images and the effect produced by slight variations in the lattice spacing. H. C. G.

Optical activity and chemical structure of tartaric acid.—See A., 1939, II, 357.

Optical activity and magneto-optical activity of crystalline nickel sulphate in the near ultra-violet. F. G. SLACK and P. RUDNICK (Phil. Mag., 1939, [vii], **28**, 241—247).—Optical and magneto-optical data previously obtained have been extended to $\lambda\lambda < 3850$ A., and an improved technique has resulted in some slight adjustment of earlier vals. (cf. A., 1938, I, 563). C. R. H.

Orientation of a suspended drop of an aniso-tropic liquid in a magnetic field. V. NAGGIAR (Compt. rend., 1939, **208**, 1916—1918).—Observations on the birefringence rings show that the optic axes in a drop of nematic p-azoxyanisole retained by a hole in a plate are parallel to the free surfaces, and uniformly inclined throughout the drop. A magnetic field parallel to the surfaces produces a parallel inclination of the axes. A magnetic field perpendicular to the drop immediately causes a corresponding orientation of the optic axes within the drop. A. J. E. W.

Comparison of the quantum-mechanical formulæ derived from magnetic birefringence with experimental results. T. NEUGEBAUER (Z. Physik, 1939, **113**, 115—125).—A comparison of the known Cotton–Mouton consts. for diat. gases with the author's theory (cf. A., 1939, I, 303). L. G. G.

Werner complexes. Optical activity and con-figuration of platinic triethylenediamine ions. J. P. MATHIEU (Bull. Soc. chim., 1939, [v], **6**, 1258—1259).—The mol. rotatory power of $[Pt\ en_3]Cl_4,3H_2O$ [en = $(CH_2\cdot NH_2)_2$] obeys the Drude equation over the λ range 6500—4000 A., but shows anomalous dispersion accompanied by circular dichroism at 3400—2700 A. The results, taken in conjunction with the extinction coeff., indicate that the configuration of the Pt complex obeys the same rules as ions of the type $[M\ en_3]^{\cdots}$ (cf. A., 1936, 410). J. W. S.

Origins of the atomic theory. J. R. PARTINGTON (Ann. Sci., 1939, **4**, 245—282).

Many-body interactions in atomic and nuclear systems. H. PRIMAKOFF and T. HOLSTEIN (Physical Rev., 1939, [ii], **55**, 1218—1234).—Mathematical. N. M. B.

General theory of heterophase fluctuations and pretransition phenomena. J. FRENKEL (J. Chem. Physics, 1939, **7**, 538—547).—Mathematical. An extension of previous work (A., 1939, I, 261) to pre-melting phenomena, " super-transition " states and crystallisation of a supercooled liquid, transitions of higher order, and Curie points. W. R. A.

Dissociation schemes of the diatomic hydrides and deuterides. E. HULTHÉN (Z. Physik, 1939, **113**, 126—133).—The electron terms of hydrides and deuterides may be classified such that their normal state is derived from the lowest atom combinations. This conflicts with Gerö and Schmid (cf. A., 1939, I, 183), who take no account of the normal state of the metal atom. The theory is supported by results for AlH and AlD. L. G. G.

Centrifugal distortion of axial molecules. Z. I. SLAWSKY and D. M. DENNISON (J. Chem. Physics, 1939, **7**, 509—521).—Mathematical. The theory of the semi-rigid rotator (A., 1936, 667, 782) has been applied to axial mols. of types YX_3 and ZYX_3. The change in rotational energy due to centrifugal distortion is given in terms of the quantum nos. J and K, the potential consts., and the mol. dimensions. Formulæ are given for NH_3 and ND_3 and comparison of calc. and observed rotation lines of these mols. is satisfactory. PH_3 and Me halides are also discussed. W. R. A.

Skeletal modes of vibration of long chain molecules. J. G. KIRKWOOD (J. Chem. Physics, 1939, **7**, 506—509).—Mathematical. The method of Born *et al.* for the determination of the normal modes of vibration of crystals has been applied to determine approx. the skeletal frequencies of C_3H_8, $n\text{-}C_6H_{14}$, and $n\text{-}C_7H_{16}$. W. R. A.

Molecular oscillators in aromatic molecules. F. LONDON (Compt. rend., 1939, **208**, 2059—2061; cf. A., 1937, I, 19).—Theoretical. Transitions between Brillouin zones are considered in relation to the circulation of electrons and the production of directional vibrations in aromatic mols. (cf. A., 1938, I, 123). A. J. E. W.

Dipole–dipole resonance forces. G. W. KING and J. H. VAN VLECK (Physical Rev., 1939, [ii], **51**, 1165—1172).—The r^{-3} variation of polarisation energy of a mol. composed of two identical atoms obeyed at fairly large interat. distances r is examined theoretically. Experimental and calc. data are plotted and discussed for the first excited states of H_2, Na_2, Cd_2, and Hg_2. N. M. B.

Internal rotation and resonance in hydro-carbons. E. GORIN, J. WALTER, and H. EYRING (J. Amer. Chem. Soc., 1939, **61**, 1876—1886).—Mathematical. Consideration of the restricted rotation about the C·C linking of C_2H_6 indicates that repulsion between H atoms cannot account for the barrier of 3000 g.-cal., nor is the barrier due to distortion of the spherical symmetry around the C atoms by perturbation of the H atoms. Resonance with double-bonded structures, assuming reasonable vals. for the angular dependence of exchange integrals between C orbitals, yields a barrier height of 700 to 1900 g.-cal. When the effect of dissymmetry of C atoms is added to this a barrier of the correct order is obtained. This resonance effect also explains alternation in physical

properties of long-chain compounds. Evidence (X-ray, electron diffraction, Raman effect, infra-red absorption spectra, heat of combustion) concerning the relative stability of staggered and opposed configurations for long-chain and cyclic compounds is reviewed.   W. R. A.

Calculation of the shape of protein molecules. A. POLSON (Kolloid-Z., 1939, **88**, 51—61; cf. A., 1936, 879).—The axial ratio b/a and length b of various protein mols., considered as ellipsoids of revolution, have been calc. from the equations of Herzog *et al.* (A., 1934, 357) and Perrin (A., 1937, I, 283). In every case b is the same for the undissociated mol. as for its dissociation product. An empirical modification of Kuhn's equation enables the mol. wts. to be calc. with good approximation from measurements of η, sp. vol., and diffusion const.   F. L. U.

Linking energy of the carbon atom. R. SCHMID (Mat. Term. Értesitö Tud. Akad. III. Oszt. Fol., 1936, **54**, 769—793; Chem. Zentr., 1937, i, 1653).—The free energy changes (ΔA) for a no. of elementary processes are calc. from Parks and Huffman's data and the dissociation energy of CO (159 kg.-cal.). The ΔA vals. can also be calc. to within 1—2% from the following linking energies: C·C 80, C·H 96·5, C·Cl 72·5, C:S 135·6, C:N 180, C·O 75 kg.-cal. The C:O linking energy in aldehydes and ketones is 159, and in CO_2 ~189 kg.-cal.   A. J. E. W.

Potential functions of the methyl halides. Z. I. SLAWSKY and D. M. DENNISON (J. Chem. Physics, 1939, **7**, 522—529).—Mathematical. Using a valency form of potential containing five consts., two of which were assumed to be the same for all Me halides, it was possible to predict to 10% the six fundamental νν, and two of the fine structure spacings for Me halides.   W. R. A.

Potential function of halogenated derivatives of ethane and ethylene. A. VERLEYSEN (Ann. Soc. Sci. Bruxelles, 1939, [i], **59**, 267—284).—The potential functions of EtBr have been recalc. and used to evaluate the fundamental frequencies of EtBr, $CH_3D·CH_2Br$, $CHD_2·CD_2Br$, and C_2D_5Br. The vals. so obtained agree fairly with those observed. Similar calculations are made for $CH_2Br·CH_2Br$, CHDBr·CHDBr, $CD_2Br·CD_2Br$, C_2H_3Cl, *cis-* and *trans-*CHCl:CHCl, *cis-* and *trans-*CDCl:CDCl, $CH_2:CCl_2$, and C_2Cl_4. The general inference is drawn that the rigidity of the C·C linking decreases, and the C·X (halogen) valency force and the force opposing deformation of the angle C–C–X increase, with the successive entry of X atoms, and that the last two effects are more pronounced when two X are attached to the same C.   F. L. U.

Energy ratio of the OH–OH linking. H. HARMS (Z. physikal. Chem., 1939, B, **43**, 257—270).—The work which must be done against electrostatic dipole attraction in separating two associated dipoles has been calc. for polar and non-polar OH–OH association and for non-polar HBr–HBr, HCl–HCl, and HF–HF association. The results are discussed in relation to solubilities.   W. R. A.

Inter-relation of dissociation energy, internuclear distance, and bond order for carbon-carbon linkings. C. H. D. CLARK (Nature, 1939, **143**, 800—801; cf. A., 1938, I, 62).—The heat of dissociation, D, the internuclear distance, r_e, and bond order, x, are connected by the approx. relationships $Dr_e^3 = 282$ and $x^{2/3}r_e^3 = 3·7$.   L. S. T.

Correlation between the electronegativity series of organic radicals and bond moments. H. C. BROWN (J. Amer. Chem. Soc., 1939, **61**, 1483—1486).—Bond moments for R–Cl increase thus: R = CPh:C < CHPh:CH < CHMe:CH < CH_2:CH < C_6H_4Me < Ph < Me < Et < Pr^a < Bu^a, *n*-amyl < Pr^β < *cyclo*hexyl, allyl, CH_2Ph < Bu^γ < $CHPh_2$ < CPh_3. The order of increasing electronegativity (determined by the stability of HgR_2) corresponds, so far as it has been determined, with the order of decreasing bond moment. The same factors are thus responsible for both effects.   R. S. C.

Probable length of hydrocarbon chains. (MISS) L. LASKOWSKI and R. E. BURK (J. Chem. Physics, 1939, **7**, 465—469).—Mathematical. The average distance between the centres of the first and last C of a freely rotating hydrocarbon chain is 1·50 times the C—C distance (1·54 A.), which corresponds with a spherical configuration of a thread-like mol. When rotation is restricted by geometric interference the length is a function of the radius of H atoms and vals. in good agreement with experimental data of Mack are obtained. These vals. are approx. those for a freely rotating mol. and are ≤ the extended length.   W. R. A.

Magnetism and polymerisation [of dimethyl-butadiene]. J. FARQUHARSON and (MISS) P. ADY (Nature, 1939, **143**, 1067—1068).—Graphs reproduced for the magnetic susceptibility of dimethylbutadiene at the commencement of polymerisation in presence and absence of Bz_2O_2 show that in absence of a catalyst diamagnetism falls for the first 3 hr. and then rises steadily. The fall in diamagnetism may be due to the formation of free radicals, which are paramagnetic, acting as polymerisation nuclei. The concn. of such centres is the same as that of the catalyst necessary to give a smooth curve.   L. S. T.

Structure and properties of high mol. wt. organic compounds. V. V. RAZUMOVSKI (J. Gen. Chem. Russ., 1939, **9**, 460—466).—Theoretical.   R. T.

Parachor. P. BOGDAN (Compt. rend., 1939, **208**, 2069—2070).—The relation $\gamma V/T^{2/3} = 1$ leads to the expression $[P] = T^{1/4}V^{5/6}$, which gives the "neoparachor," $[P_n]$, derived only from the b.p.; V is evaluated from Kopp's consts. $[P_n]$ and Sugden's additive $[P]$ val. are compared in certain cases, and their use in conjunction is illustrated. The val. of $\gamma V^{2/3}$ at the b.p. (calc. from Sugden's $[P]$) is generally $> T$ for normal and $< T$ for associated compounds.   A. J. E. W.

Surface tension and angle of contact of mercury in vacuo. A. E. BATE (Phil. Mag., 1939, [vii], **28**, 252—255).—Clean dry Hg in an evacuated tube had an angle of contact (α) 90° and a surface tension of 490 dynes per cm. After admitting air to the tube the Hg

meniscus became convex with $\alpha = 100°$. After two days α had increased to $135°$.   C. R. H.

Measurements of the intensity distribution of the white X-radiation reflected from a crystal : dispersion of the atomic scattering factor of zinc near the K absorption edge. J. C. M. BRENTANO, (MISS) J. HONEYBURNE, and J. K. BERRY (Proc. Physical Soc., 1939, 51, 668—682).—The reflexion of the radiation emitted from an X-ray tube by a crystal in an X-ray goniometer gives a pattern of lines on a general background constituted by white radiation from the tube, reflected regularly from the crystal, and by other radiation. A method for the separate assessment of these two background constituents is described, permitting accurate measurement of the intensity-distribution of the reflected white radiation, and is applied to the background discontinuities which form a source of error in the evaluation of reflexion line intensities (cf. A., 1937, I, 552). The method is discussed with reference to the determination of the dispersive change of the at. scattering factor near an absorption edge ; by its use f vals. for $\lambda\lambda$ close to the edge can be obtained. Results of experiments on the long-wave side of the Zn K-absorption edge are compared with the wave-mechanical dispersion curve.   N. M. B.

Application of a proportional amplifier to X-ray structure analysis. B. ISAEV (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 42—44).—A proportional amplifier for use in determination of crystal structure by X-ray analysis is described. It will amplify ionisation currents by 10^4, and can therefore be used to examine the structure of substances which will give only a weak diagram, and makes it possible to carry out measurements directly with the use of an electrometer instead of making lengthy photographic exposures. The instrument has been used in the examination of the crystal structure of frog muscle. There are two max. corresponding with identity periods of 10 and 4.5 A. A displacement of the position of the max. occurs as the tissue dries. The method has also been applied to the examination of the structure of Cu and of $NH_2 \cdot CH_2 \cdot CO_2Ag$.   A. J. M.

Homometric structures. A. L. PATTERSON (Nature, 1939, 143, 939—940).—The term "homometric" is used to describe the relation between two structures which possess the same interat. distances, and is restricted to structures giving the same X-ray diffraction pattern. Two point positions each of which leads to two non-identical homometric structures for positive and negative vals. of a single parameter are discussed. The genesis of the homometric property is examined.   L. S. T.

Positions and packing of congruent circles in a plane. U. SINOGOWITZ (Z. Krist., 1939, 100, 461—508).—A rigorous mathematical analysis from the viewpoint of group theory is made and illustrated in 131 diagrams.   I. McA.

Classification of closest and close packings. N. V. BELOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 170—174).—A discussion of the no. of theoretically possible modes of close packing of atoms in crystals.   J. A. K.

Atom [form] factors for some heavy ions. G. DASCOLA (Z. Krist., 1939, 100, 537—539).—Theoretical. X-Ray scattering factors, expressed as a function of glancing angle and λ, are calc. by the method of Nagy (A., 1934, 1285 ; 1935, 679) for the ions $Na^{\cdot}$, $K^{\cdot}$, $Ca^{\cdot\cdot}$, $Cu^{\cdot}$, $Mn^{\cdot\cdot}$, $Co^{\cdot\cdot\cdot}$, $Co^{\cdot\cdot}$, $Ni^{\cdot\cdot}$, $Cu^{\cdot\cdot}$, $Zn^{\cdot\cdot}$, $As^{\cdot\cdot\cdot}$, $Cd^{\cdot\cdot}$, $Sn^{\cdot\cdot}$, $Sb^{\cdot\cdot\cdot}$, $Hg^{\cdot\cdot}$, $Pb^{\cdot\cdot}$, and $Bi^{\cdot\cdot\cdot}$. Curves for the first four are compared with other determinations (by Hartree, Fermi, Pauling).   I. McA.

Growth of crystals from the vapour phase. J. EHLERS (Schr. min.-petrog. Inst. Univ. Kiel, 1935, 2, 24 pp. ; Chem. Zentr., 1937, i, 1639).—Growth of As_2O_3 crystals from the vapour phase occurs only in the octahedral form. The growth faces carry a condensed adsorption layer in which formation and growth of the nuclei occur. The octahedral arrangement of O atoms and other crystallographic details account for exclusive growth on (111) faces, and also for parallel growth, spinel twinning, and skeleton formation. Observations on $HgCl_2$, $HgBr_2$ (which gives a new rhombic form), HgI_2, and mixed crystals are made.   A. J. E. W.

Powder patterns on permalloy crystals. J. W. SHIH and T. Y. CHAI (Physical Rev., 1939, [ii], 55, 1265).—The formation of powder patterns on permalloy (Ni 84, Fe 16%), polished with Al_2O_3 powder, indicates that the origin of inhomogeneities of surface magnetisation is not a magnetostriction effect since permalloy has practically no magnetostriction. The mechanical polishing probably produces fragment structure in the surface just below the Beilby layer (cf. Elmore, A., 1937, I, 449).   N. M. B.

Crystal structure of Al_2Ca. H. NOWOTNY and A. MOHRNHEIM (Z. Krist., 1939, 100, 540—542).—The Al_2Ca phase obtained by heating Al with Ca in a sealed quartz tube at $900°$ has been examined by precision powder X-radiograms. The face-centred cubic cell with a 8.022 A. contains 8 mols. ; ρ 2.35. Analysis of indexed estimated intensities favours the space-group O_h and yields for the Al—Al distance 2.83, Ca—Ca 3.47, and Al—Ca 3.32 A. Weak polarisation is inferred.   I. McA.

Crystal structures of rubidium and cæsium [mon]oxides. A. HELMS and W. KLEMM (Z. anorg. Chem., 1939, 242, 33—40).—Rb_2O has the anti-CaF_2 structure, with a 6.74 A. Cs_2O has the anti-$CdCl_2$ structure, with a 6.74 A., α $36.93°$.   F. J. G.

Oriented displacement of magnetite by iron. V. A. FRANK-KAMENETZKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 561—564).—The orientation of the lattice of Fe formed by reduction of Fe_3O_4 parallel with that of the original Fe_3O_4 crystal (cf. A., 1939, I, 304) is explained by the fact that the Fe atoms in the Fe_3O_4 need only to be displaced in the (001) direction to give the lattice of α-Fe ; an elementary cell of magnetite gives three layers of at. Fe.   L. J. J.

X-Ray study of the crystal structure of silver sulphide. G. GOLL and T. BAKOS (Magyar Chem. Fol., 1936, 42, 110—116 ; Chem. Zentr., 1937, i, 1640).—A cuprite structure (a 4.89 A.) is confirmed.   A. J. E. W.

Crystal structure of synthetic antimony trisulphide. H. P. KLUG and G. B. HEISIG (J. Amer. Chem. Soc., 1939, **61**, 1920—1921).—Red Sb_2S_3, obtained by passing H_2S through an HCl solution of $SbCl_3$ containing tartaric acid, is converted into black Sb_2S_3 at 115°. X-Ray powder photographs reveal that the red variety is amorphous, whilst the black is cryst. and identical with natural stibnite, Sb_2S_3.
W. R. A.

Structure of solid hydrogen fluoride. P. GÜNTHER, K. HOLM, and H. STRUNZ (Z. physikal. Chem., 1939, B, **43**, 229—239).—Debye-Scherrer photographs of solid $(HF)_x$ at 91° K. indicate that the crystals are tetragonal or pseudotetragonal, a 5·45, c 9·95 A., with four zig-zag chains of four mols. The distance F—H—F is ~2·7 A. and the angle FH–FH–FH is ~134°.
W. R. A.

Crystal structure of $TiAl_3$, $NbAl_3$, $TaAl_3$, and $ZrAl_3$. G. BRAUER (Z. anorg. Chem., 1939, **242**, 1—22).—A detailed account of work already noted (A., 1939, I, 18).
F. J. G.

Methods of investigating the structure of ice. P. S. VADILO (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 343—344).—Disadvantages of the usual methods of investigating the structure of ice are reviewed. In a new method the ice is exposed in damp air at a few degrees >0°; sublimation ensues and fine crystals, formed over the ice, are oriented according to the orientation of the crystal axes of the specimen selected. Every "sublimed" crystal becomes covered with faces and crystal structure can be determined. In another new method, graph paper or thin textile material is placed on the bottom and side surfaces of a piece of ice and shaded with a soft pencil; the boundaries between separate monocrystals of ice become manifest and lines also appear from which the area of each crystal can be determined.
W. R. A.

Relations between true crystal growth and lattice defects, studied by the crystallisation of sodium nitrate from the melt. R. TIEMEYER (Schr. min.-petrog. Inst. Univ. Kiel, 1935, **1**, 24 pp.; Chem. Zentr., 1937, i, 1639).—$NaNO_3$ single crystals obtained by slow cooling in a temp. gradient from ≯60° above the m.p. are studied. Growth is most regular near the point of commencement of crystallisation, and in a pointed vessel. The orientation of the single crystal is independent of the direction of the temp. gradient. Defective orientation of the lattice blocks occurs by rotation of the blocks about defined axes, particularly [100], the direction of shortest distance between ions of opposite sign. The nuclear centre is an ordered aggregate of lattice blocks.
A. J. E. W.

Crystallo-optical analysis of strontium aluminates. N. A. TOROPOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 74—75).—Sr aluminates have been prepared synthetically and examined microscopically. $3SrO,Al_2O_3$ crystallises in trapezohedrons of the cubic system. It is optically isotropic, n 1·728±0·003. A compound of the type $5CaO,3Al_2O_3$ has not been found in the $SrO–Al_2O_3$ system. SrO,Al_2O_3 crystallises in prisms. Pseudohexagonal twinning is frequently encountered. It reacts with H_2O. Its bire-

fringence is ≪ that of the corresponding Ca compound. $SrO,2Al_2O_3$ forms prismatic crystals optically positive. $SrO,6Al_2O_3$, the analogue of $BaO,6Al_2O_3$, and other aluminates of the β-type form uniaxial, optically negative crystals.
A. J. M.

X-Ray investigation of $LiBi_3O_4Cl_2$ and related substances. L. G. SILLÉN (Z. anorg. Chem., 1939, **242**, 41—46).—By dissolution of Bi_2O_3 or BiOCl in the appropriate fused halide the following compounds have been obtained : $LiBi_3O_4Cl_2$ (I), $LiBi_3O_4Br_2$ (II), $LiBi_3O_4I_2$ (III), $NaBi_3O_4Cl_2$ (IV), $NaBi_3O_4Br_2$ (V), $NaBi_3O_4I_2$ (VI), and $Cd_2Bi_3O_4Br_2$ (VII). They are all tetragonal, space-group D_{4h} (4/mmm), and the lattice consts. are : (I) a 3·840, c 12·03 A.; (II) a 3·876, c 12·47 A.; (III) a 3·941, c 13·19 A.; (IV) a 3·877, c 12·13 A.; (V) a 3·925, c 12·55 A.; (VI) a 3·990, c 13·31 A.; (VII) a 3·943, c 12·62 A. At. positions are given.
F. J. G.

Crystal structure and crystallo-chemical properties of heteropoly-compounds. Crystallographic and X-ray investigations on a new group of hydrates of 12-heteropoly-acids. O. KRAUS (Z. Krist., 1939, **100**, 394—413; cf. A., 1937, I, 118, 288).—The $14H_2O$ hydrates of $H_4SiW_{12}O_{40}$, $H_5BW_{12}O_{40}$, $H_4SiMo_{12}O_{40}$, $H_3PW_{12}O_{40}$, and $H_3PMo_{12}O_{40}$ form an isomorphous triclinic series with face-centred cells containing 8 mols.; space-group C_i. Preps. are described, and cell elements, ρ, and typical goniometric data determined. The structural isotypy of the numerous $H_m[XY_{12}O_{40}],nH_2O$ group members which are pseudocubic is discussed in terms of the modes of association of the $[XY_{12}O_{40}]$ anion and hydrated cation units. A comparison with silicates is made. Within cationic tolerance limits, isomorphism extends to related salts (e.g., to the Li, Hg,$15H_2O$, and Th salts for $H_4SiW_{12}O_{40}$,$14H_2O$).
I. McA.

X-Ray determination of the structure of tetramethylammonium dichloriodide crystals, NMe_4ICl_2. R. C. L. MOONEY (Z. Krist., 1939, **100**, 519—529; cf. A., 1938, I, 347).—Structural analysis of the trihalogen ion is favoured by a cation of low scattering power and radius ~ that of Cs'. NMe_4ICl_2 is tetragonal, a 9·18, c 5·80 A.; ρ 1·74; 2 mols. per cell; space-group D_{2d}^3–$P\bar{4}2_1m$. Complete at. parameters and inter-distances are determined in accord with visual intensities of oscillation X-radiograms (Mo Kα). The structure is essentially that of NMe_4I with the larger linear symmetric ICl_2' (I—Cl = 2·34 A.), packed in planes perpendicular to the tetragonal axis, causing a lateral cell extension of 16%.
I. McA.

Crystal structure of glucosamine hydrobromide [and α-chitosamine]. E. G. COX and G. A. JEFFREY (Nature, 1939, **143**, 894—895).—The crystal structures of α-chitosamine hydrochloride and hydrobromide have been determined without reference to stereochemical data. Both are monoclinic sphenoidal, space-group $P2_1$, with 2 mols. per cell, the dimensions of which are a 7·68, 7·96, b 9·18, 9·29, c 7·11, 7·18 A., and β 112° 29' and 112° 35', respectively. A diagram showing the structure projected on the (010) plane is reproduced, and at. co-ordinates are tabulated. The analysis shows that (i) for the first time the configur-

ation of a C compound containing several asymmetric centres has been confirmed by direct determination of at. positions and, in particular, that chitosamine is a derivative of glucose and not of mannose (cf. A., 1939, II, 144), (ii) the pyranose ring has a real existence in a cryst. sugar, and (iii) in the α-form of a d-glucose derivative the O on the first and second C are in cis-positions. L. S. T.

Electron diffraction investigation of the structure of benzene, pyridine, pyrazine, butadiene-1 : 3, cyclopentadiene, furan, pyrrole, and thiophen. V. SCHOMAKER and L. PAULING (J. Amer. Chem. Soc., 1939, **61**, 1769—1780).—From an electron diffraction investigation of C_6H_6 (I), C_5H_5N (II), pyrazine (III), $(CH_2:CH)_2$ (IV), cyclopentadiene (V), furan (VI), pyrrole (VII), and C_4H_4S (VIII) the following interat. distances have been obtained (in A.) : C—H, 1·08±0·04 (I), 1·09 (II), (III), (V), (VI), (VII), (VIII), 1·06 (IV); C—C, 1·39±0·02 (I), 1·39 (II), (III), 1·46± 0·03 (IV), 1·46±0·04 (V), 1·46 (VI), 1·44 (VII), (VIII); C—X (X = S, O, N), 1·37±0·03 (II), 1·35±0·02 (III), 1·53 (V), 1·41±0·02 (VI), 1·42±0·02 (VII), 1·74±0·03 (VIII); C꞉C, 1·35±0·02 (IV), 1·35 (V), (VI), (VII), (VIII). Valency angles are : C–X–C, 101±4° (V), 107±4° (VI), 105±4° (VII), 91±4° (VIII); X–C꞊C, 109±3° (V), (VI), 110±3° (VII), 112±3° (VIII); C꞊C–C, 124±2° (IV), 110±2° (V), 107±2° (VI), 108±2° (VII), 113±3° (VIII). In (II) and (III) the C—N distance is > that expected for Kekulé resonance, presumably due to extra resonance with ionic structures. The degree of resonance stabilisation is in the order (VI) < (VII) < (VIII) as determined by electron diffraction data, electric dipole moment data, resonance energies, chemical information, and simple theoretical considerations. The contribution of excited structures to these mols., other than those characteristic of the conjugated double linkings, are ~10, 24, and 34% respectively. Part of the resonance of (VIII) is with structures with 10 electrons in the valency shell of the S atom. W. R. A.

Crystal structure of diphenyldiacetylene. E. H. WIEBENGA (Nature, 1939, **143**, 980—981).—Rotation, Weissenberg, and Laue diagrams give a 6·61, b 6·04, c 14·92 A., β 105°; 2 mols. per unit cell; $d_{calc.}$ and $d_{obs.}$ are 1·63; probable space-group C_{2h}^5 ($P_{21/c}$). The long axes of the mols. form angles of 42°, 38°, and 78° with the a, b, and c axes, respectively. The mols. are flat with straight C chains. The planes of the Ph rings of the two sets of mols. are not parallel with each other or with one of the basal planes. The shortest distance between C of two different mols is 3·45—3·65 A.; it occurs between C of the Ph. L. S. T.

Molecular structure of 1 : 2 : 4 : 5-tetrabromo-cyclohexane (m.p. 185°). E. HALMÖY and O. HASSEL (J. Amer. Chem. Soc., 1939, **61**, 1601—1602).—1 : 2 : 4 : 5-Tetrabromocyclohexane is orthorhombic. Bragg photographs give a 7·98, b 7·90, c 7·89 A.; space-group D_2^3—$P2_12_12$; 2 mols. in unit cell. The dipole moment has been determined. P_{A+o} = 104·6, μ = 2·2₂ D. Electron diffraction diagrams of the vapour agree with the model of the mol. based on X-ray observations. A. J. M.

X-Ray crystal analysis of trans-azobenzene. J. J. DE LANGE, J. M. ROBERTSON, and I. WOODWARD (Proc. Roy. Soc., 1939, A, **171**, 398—410).—The crystal structure and mol. dimensions of the ordinary or trans-form of azobenzene have been determined. Two independent mols. contribute to the unit; one is flat, but in the other the rings lie in different planes. Vals. of interat. distances are given. G. D. P.

Structure of aromatic polynitro-compound–hydrocarbon complexes. H. M. POWELL and G. HUSE (Nature, 1939, **144**, 77).—The 1 : 1 mol. compound of picryl chloride (I) and C_6Me_6 is orthorhombic with a 14·0, b 9·0, c 15·4 A.; space-group $Amam$ or Ama. As no pyro-electric effect is detectable the crystals probably have a symmetry centre. All (I) mols. lie in two sets of planes parallel to (100) separated by a distance of 7 A., whilst those of C_6Me_6 lie in two sets of planes parallel to and half-way between these. There are no valency linkings between (I) and C_6Me_6. Anomalous X-ray diffraction effects show some degree of disorder in the structure, and comparison with the corresponding bromide and iodide shows that the NO_2 mols. are disordered. The structure of the C_6Me_6 layers is identical with that of a single layer in the crystal of (I) itself. L. S. T.

Benzil—a skew molecule? C. C. CALDWELL and R. J. W. LE FÈVRE (Nature, 1939, **143**, 803).—Data obtained for the dipole moments of benzil (I) and phenanthraquinone in various solvents indicate that (I) has a skew configuration in which the two COPh units lie in planes which are approx. at right angles to each other. L. S. T.

Structure of benzil. I. E. KNAGGS and K. LONSDALE (Nature, 1939, **143**, 1023—1024; cf. A., 1927, 612).—X-Ray measurements of cryst. benzil show that the mol. must be of the skew type (see above). The crystals will contain spirals of O atoms somewhat similar to those found in quartz. Simpler mol. structures eliminated by these measurements are discussed. L. S. T.

Crystallographic investigation of artostenone, the stenone isolated from the Indian summer fruit, Artocarpus integrifolia, by means of goniometer and X-rays. M. C. NATH and P. L. MUKHERJEE (J. Indian Chem. Soc., 1939, **16**, 229—234).—The crystals belong to the monoclinic system; plate faces a (100) show pronounced elongation along the c axis; a 17·3, b 10·2, c 7·4 A., β 100° 49′, ρ 1·083, 2 mols. per unit cell, mol. wt. 424·2. The close similarity between the C skeletons of artostenone and ergosterol is pointed out. W. R. A.

Relation between the lattices of natural and hydrated cellulose. E. SAUTER (Z. physikal. Chem., 1939, B, **43**, 294—308; cf. A, 1937, I, 604).—A discussion of the data recorded on the lattice structures of natural and hydrated cellulose indicates that the data of Sponsler and Dore (A., 1928, 939) most accurately represent the lattices of the two substances. An explanation of the polymorphism between the two substances is given. W. R. A.

Macromolecular compounds. Lattice estimation of rubber. E. SAUTER (Z. physikal. Chem., 1939, B, **43**, 292—293).—The vals. for the rhombic

cell of cryst. rubber (A., 1937, I, 585) have been confirmed independently by Morss (J. Amer. Chem. Soc., 1938, **60**, 237).　　　W. R. A.

Structure of insulin. I. LANGMUIR and (MISS) D. WRINCH (Proc. Physical Soc., 1939, **51**, 613—624). —The modified (0001) vector projection for an insulin crystal, examined in relation to the C_2 structure proposed for the insulin mol., confirms the C_2 structure represented by the discron (electron density deviation) system $3s + 3s' - o$ provided it is adequately loaded at its slits. Bernal's suggestion of an 18-discron set structure is shown to be untenable.　　　N. M. B.

Structure of proteins. I. LANGMUIR (Proc. Physical Soc., 1939, **51**, 592—612).—A lecture. 　　　N. M. B.

Structure of silver films. O. GOCHE and H. WILMAN (Proc. Physical Soc., 1939, **51**, 625—651).— An electron diffraction study of the structure of Ag films condensed in vac. on rock-salt cleavage faces at ~200°, and of the changes produced by heating the films in vac., shows that the reflexion and transmission patterns are in general agreement with Menzer's view of twinned structure of films. General equations are derived for use in considering the geometrical features of rotation patterns yielded by cubic crystals. Heating in vac. at ~500° quickly converts the films into normal relatively perfect single crystals, and such an extensive at. rearrangement is evidence of high mobility of Ag atoms at temp. well below the m.p. not only on the surface but within the lattice. 　　　N. M. B.

Examination of worked metal surfaces by means of electron interference. E. PLESSING (Z. Physik, 1939, **113**, 36—55).—Test pieces of Au, Ni, Ag, Fe, Cu, and Zn polished under C_6H_6, in pure N_2 and in vac., give the same electron diffraction images, themselves identical with those obtained from similar pieces polished in air. The lack of influence of O_2 is also shown by heating polished Ni surfaces in vac. to give a cryst. surface, when the diffraction pattern is that of pure Ni. Polished Zn gives diffraction images which do not correspond with either Zn or ZnO, but rather with a quasi-fluid metal layer. None of the gaseous components of air affects the uppermost layer of metal surfaces during polishing and working. 　　　L. G. G.

Magnets. W. L. BRAGG (Proc. Roy. Inst., 1939, **30**, 783—787).—A lecture.

Freely suspended bodies in electric and magnetic fields. W. BRAUNBEK (Z. Physik, 1939, **112**, 753—763).—It is shown mathematically that a static, stable, free suspension of a system consisting of an electrically non-conducting, rigid body in the electric, magnetic, and gravitational fields of a second system is impossible unless at least one of the systems contains diamagnetic material.　　　L. G. G.

Free suspension of a diamagnetic body in a magnetic field. W. BRAUNBEK (Z. Physik, 1939, **112**, 764—769).—The construction of a powerful electro-magnet with specially shaped pole shoes is described, the field of which, in air, is capable of the free suspension of Bi (8 mg.) and of arc-lamp C (75 mg.). The method of location of the positions of

stability, at which points the particles may be touched or blown into oscillations of amplitude of 1 cm. without loss of equilibrium, is described. 　　　L. G. G.

Axial magnetic permeability of wires and thin layers of iron at high frequencies. N. A. FLORESCU (Compt. rend., 1939, **208**, 1717—1719; cf. A., 1927, 505; 1932, 448).—Data are recorded for 0·051- and 0·08-mm. Fe wires (λ 80—275 m.) and a partly oxidised Fe layer (80 mμ.) obtained by cathodic sputtering. The decrease of axial permeability at short λλ becomes marked at 200 m.　　　A. J. E. W.

Can crystals of lower symmetry also be excited piezoelectrically in a simple way? B. PAVLÍK (Z. Krist., 1939, **100**, 414—419).—Mathematical. Consideration of the piezoelectric moduli characterising the hemihedral and hemimorphic classes of monoclinic crystals shows how crystal plates may be cut so that angular distortion is suppressed to give linear oscillations only. Theory is confirmed by dust-figures obtained for sucrose. 　　　I. McA.

Hall effect in an $AuCu_3$ alloy in and out of the orderly condition. A. KOMAR and S. SIDOROV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 143— 144).—It has been predicted theoretically that the magnitude of the Hall effect in alloys should change at an order–disorder transition. This has been confirmed experimentally for $AuCu_3$, a three-fold change in the Hall const. being observed.　　　J. A. K.

Optical properties of very thin layers of potassium. D. HACMAN (Compt. rend., 1939, **208**, 1982— 1984; cf. A., 1931, 406; 1932, 1071).—The technique of determining the absorption and reflexion coeffs. (A, B) of 0·57—23-mμ. K films at 2500—5500 A. is described. A is max. between 3600 and 3800 A.; monoat. films (0·57 mμ.) absorb only at 3500—4000 A. The max. becomes broader and is displaced to higher λλ with films >6 mμ. thick. B varies similarly, but its relatively small val. shows that the observed absorption of transmitted light is only to a small extent due to reflexion.　　　A. J. E. W.

Micellar structure and mechanism of deformation of fibrous substances. VIII. Optical study of Hermans' hydrous cellulose fibres and cellulose acetate films. O. KRATKY and P. PLATZEK (Kolloid-Z., 1939, **88**, 78—88; cf. A., 1939, I, 186).—Calculations based on the net theory agree with the observed double refraction of hydrous cellulose fibres up to an extension of 1·5, beyond which the calc. vals. are too high. An explanation is attempted. The behaviour of cellulose acetate films swollen in aq. dioxan, in contrast with that of cellulose fibres, can be approx. accounted for by assuming micellar flow. Discrepancies are greatest in the least swollen films, in which a condition intermediate between free-floating micelles and a net structure may be assumed.　　　F. L. U.

Increase in strength of quartz glass through rise of temperature. W. DAWIHL and W. RIX (Z. Physik, 1939, **112**, 654—666).—The breaking strength of quartz glass over the temp. range –60° to 800° and with different forms of heat-treatment

has been measured. The high strength exhibited at 800° cannot be produced at room temp. by any form of heat-treatment, whether followed by chilling or annealing, and is only partly explicable on a basis of healing of faults. It may be explained on the assumption of a type of quartz α–β transition in parts of the glass which still possess a cryst. structure. L. G. G.

Mechanical after-effect and chemical constitution. J. L. SNOEK (Physica, 1939, **6**, 591—592).—The logarithmic decrement (k) of a pure Fe torsion wire is nearly independent of temp. at −50° to 100°, but if the Fe contains N (~0·02%) k has a sharp max. at 9°, the height of which is ~ ∝ [N]. The height of the max. is reduced by segregation of the N as nitride due to heat-treatment. C gives a less marked but analogous effect at 24°. The phenomenon is related to a magnetic after-effect (cf. A., 1939, I, 186). A. J. E. W.

Variation of the adiabatic elastic constants of polycrystalline ammonium chloride with temperature for 200—273° K. A. W. LAWSON and R. SCHEIB (Physical Rev., 1939, [ii], **55**, 1268).—Measurements were made by the Balamuth–Rose dynamical method (cf. A., 1935, 276). Curves are given for the variation of the adiabatic Young's and rigidity moduli with temp. through the phase transition at 242·8° K., and for the corresponding variations of the adiabatic compressibility and Poisson's ratio, as calc. from these data. The abs. vals. of the Young's modulus, rigidity modulus, compressibility, and Poisson's ratio at 273·2° K. are $2·733 \times 10^{11}$, $1·096 \times 10^{11}$ dynes per sq. cm., $5·54 \times 10^{-12}$ sq. cm. per dyne, and 0·246, respectively. N. M. B.

Thixotropy of liquid helium? K. R. DIXIT (Current Sci., 1939, **8**, 254—255).—Comparison of the properties of liquid He with those of a colloid exhibiting thixotropy shows that the transition of He I to He II at the λ point may be thixotropic. This point may be explained in the same way as thixotropy by assuming that during the transition some He mols. become locked in place in their equilibrium positions in a loose-packed structure, whereas the holes may change their places; the position and arrangement of the mols. change during the transition, but the electronic configuration of the mols. remains practically unaltered. L. S. T.

Co-operative phenomena in transformations in the solid state. J. A. A. KETELAAR (Chem. Weekblad, 1939, **36**, 499—502).—The general mechanism of heteromorphous and homomorphous transformations is outlined, and the case of Ag_2HgI_4 dealt with in some detail. S. C.

Phase theory and allotropy. F. ZERNIKE (Chem. Weekblad, 1939, **36**, 514—515).—A discussion as to whether many cases included in Smits' complexity theory will not eventually be shown to be due to differences in mol. structure. S. C.

Study of the allotropes of sulphur by the X-ray diffraction method. II. S. R. DAS and K. GHOSH (Indian J. Physics, 1939, **13**, 91—105).—Two new methods of preparing S_ω are described (cf. A.,

1938, I, 504). One of these involves the cooling of liquid S; the colour of the product depends on the temp. of the liquid S. Insol. S_ω is metastable towards sol. S_α, into which it changes at high temp. at a rate which increases with temp. In the light of certain chemical evidence it is suggested that a layer of SO_2 is present in the insol. varieties of S_α and S_ω; if this is removed from S_ω it becomes sol. The second method of prep., by sublimation, gives a product which is more stable than the above but less so than the S_ω obtained from S_2Cl_2. X-Ray examination shows that the particles of colloidal S are cryst. T. H. G.

Molecular and cybotactic weight measurements of resinous and crystalline materials. H. L. BENDER (J. Amer. Chem. Soc., 1939, **61**, 1812—1816).—Mol. wts. of $PhOH–CH_2O$ resins and of cryst. abietic acid, determined from the b.p. of their solutions, show wide variation depending on the time and on the initial temp. of preparing the solution. Such mol. wts. are unsuitable for structural determinations and it is suggested that the term cybotactic wt. should be employed to represent the definite but transitory "mol. wt." obtained. Cybotactic wt. will vary with the varying wt. of the solute, particularly in the supercooled state of resins, and with the experimental conditions. The effects of manner of dissolution, solvent, original dissolution temp., time of continued reflux, and of heating and keeping cold on the cybotactic wt. have been investigated. W. R. A.

Behaviour of amorphous and crystalline quartz in electrostatic field. A. G. VON ALTHEIM (Ann. Physik, 1939, [v], **35**, 417—444).—The polarisation current and true conductivity in direct field of amorphous quartz and of cryst. quartz ∥ and ⊥ to the optic axis have been measured and their temp. variation determined. Cryst. quartz shows no true conductivity ⊥ to the optic axis. O. D. S.

Magnetism and chemistry. W. KLEMM (Angew. Chem., 1939, **52**, 493—495).—A lecture.

Temperature variation of the magnetic anisotropy of graphite. K. S. KRISHNAN and N. GANGULI (Z. Krist., 1939, **100**, 530—536; cf. A., 1935, 814).—The high susceptibility $\chi_\parallel$ along the hexagonal axis is structure-sensitive, e.g., to factors affecting the relation of the basal layers. Measurements now made for $\chi_\parallel - \chi_\perp$ and $\chi_\perp$ in the range −183° to 800° show monotonic decreases of $\chi_\parallel$ and $\chi_\perp$ with increasing temp. I. McA.

Magnetic study of the oxides of chromium and manganese. S. S. BHATNAGAR, P. L. KAPUR, and B. PRAKASH (Current Sci., 1939, **8**, 253—254).—The susceptibilities of the oxides have been measured between 293° and 580° K. on a modified form of Gouy's magnetic balance. χ for Cr_2O_3 obtained by the dehydration of Cr hydroxide, the ignition of CrO_3 and of $(NH_4)_2Cr_2O_7$ is $25·6 \pm 0·2 \times 10^{-6}$ at room temp. In each case, the $\chi–T$ curve shows a max. at higher temp. The mean val. of μ_B is 3·63 as compared with the theoretical val. of 3·87 for Cr^{III}. For CrO_2,H_2O μ_B is 2·95 compared with the theoretical val. of 2·83 for Cr^{IV}. The measurements also show that MnO_2 and Mn_2O_3 have the structures O:Mn:O and

$O(Mn{:}O)_2$, respectively, and that for MnO the observed magnetic moment of 5·91 agrees with the calc. val. of 5·92 Bohr magnetons for Mn^{II}.
L. S. T.

Thermo-magnetic and related properties of metals. T. HIRONE and N. HORI (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 497—508).—Theoretical.
D. F. R.

Supersonic absorption in helium. P. KRAS-NOOSCHKIN and E. PUMPER (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 448—449).—Preliminary measurements of the supersonic absorption in He at frequencies from 586 to 952 kHz. indicate that the recorded data for He and Ne are erroneous. The present measurements support the theory of Stokes and Kirchhoff for the absorption of a sound wave by a monat. gas, as do the previous data for A (A., 1939, I, 189).
W. R. A.

Diphenylmethane as a thermometric standard at 25°. T. DE VRIES and H. A. STROW (J. Amer. Chem. Soc., 1939, **61**, 1796—1798).—Purified CH_2Ph_2 has m.p. 25·09±0·01°. CH_2Ph_2 which has been kept in a clear glass bottle in the presence of diffused light shows a marked lowering of the m.p. (24·98° after 4 weeks). After long exposure to light a brown colour develops and the m.p. falls to 24·1°. The m.p. falls to 25·090° from 25·092° in 4 weeks when the substance is stored in a brown bottle.
W. R. A.

Atomic heat of iron from 1·1° to 20·4° K. W. H. KEESOM and B. KURRELMEYER (Physica, 1939, **6**, 633—647).—The technique of the measurements in liquid He and H_2 is outlined. The results are expressed by $C_v = \gamma T + bT^3$ ($\gamma = 1\cdot20 \times 10^{-3}$; $b = 4\cdot70 \times 10^{-6}$, giving a Debye characteristic temp. of 462° K.), except for a small positive deviation at ~13·5° K., which is ascribed to vaporisation of H_2 in cavities in the specimen. The high γ val. is considered in detail, with reference to Stoner's theory.
A. J. E. W.

Anomalous properties of some anhydrous salts of the iron group at low temperatures. S. SHALYT (Nature, 1939, **143**, 799).—Ni, Co, Fe^{II}, and Cr chlorides show jumps in the sp. heat similar in shape to those exhibited by ferromagnetics. At the temp. of the sp. heat jump $FeCl_2$, $CoCl_2$, and CoI_2 exhibit a max. of susceptibility the position and sharpness of which depend on the intensity of the magnetic field. The dependence of susceptibility on the field, the anomaly of the sp. heat, and the temp.-dependence of the susceptibility can be explained by the quenching of the orbits of metallic ions in the electric field of the crystal. At temp. < that of the susceptibility max. the magneto-caloric effect of $FeCl_2$ and $CoCl_2$ is negative, i.e., the salt cools when the magnetic field is applied, and the position and magnitude of the sp. heat jumps depend on the intensity of the magnetic field. These facts support the above hypothesis and cannot be explained by the ordinary transition to the ferromagnetic state.
L. S. T

Specific heat of copper sulphate below 1° K. J. ASHMEAD (Nature, 1939, **143**, 853—854).—The sp. heat of $CuSO_4,K_2SO_4,6H_2O$ (I) exhibits only a sharp rise due to magnetic interaction at very low temp. $CuSO_4,5H_2O$ has a relatively large sp. heat throughout the whole range below 1° K. and the magnetic interaction max. is shifted to a higher temp. In $CuSO_4,H_2O$ there appears to exist a splitting of the energy levels to give a high sp. heat in the He range. (I) compares favourably with Cs Ti alum as a means of reaching extremely low temp.
L. S. T.

Anomaly of the specific heat of potassium dihydrogen phosphate at the upper Curie point. W. BANTLE and P. SCHERRER (Nature, 1939, **143**, 980).—A marked anomaly of sp. heat of ~130 g.-cal. per mol. per degree has been observed.
L. S. T.

Specific heats of some solid aliphatic acids and their ammonium salts and the atomic heat of nitrogen. S. SATOH and T. SOGABE (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 97—105).—The sp. heats of $H_2C_2O_4$, $(CH_2 \cdot CO_2H)_2$, $(OH \cdot CH \cdot CO_2H)_2$ and pyrotartaric acid and their mono- and di-NH_4 salts have been investigated. The at. heat of N, deduced from the differences between the mol. heats of the salts and the corresponding acids, is found to be generally ~4·2 as compared with 3·5 deduced from various nitrides (A., 1939, I, 310), but vals. from 1·8 to 6·4 were obtained.
W. R. A.

Heat capacity and entropy, heats of fusion and vaporisation, and the vapour pressure of dimethylamine. J. G. ASTON, M. L. EIDINOFF, and W. S. FORSTER (J. Amer. Chem. Soc., 1939, **61**, 1539—1543).—$NHMe_2$, prepared from $NO \cdot C_6H_4 \cdot NMe_2$, has m.p. 180·97° K., b.p. 280·04° K. The v.p., from 201° K. to the b.p., is given by $\log_{10} p$ (mm.) = $-2460\cdot100/T - 8\cdot63900 \log_{10}T + 7\cdot60550 \times 10^{-3}T + 3\cdot51389 \times 10^{-5}T^2 + 5\cdot32410 \times 10^{-8}T^3 + 32\cdot26370$. Using the apparatus described elsewhere (A., 1939, I, 490) the molal heat capacity has been measured from 14° to 280° K. The heats of fusion and evaporation are, respectively, 1420·1±0·5 and 6330±3 g.-cal. per mol. The molal entropy of the ideal gas at the b.p., 64·28±0·05 entropy units, differs from the val. deduced from data on the mol. spectra by an amount equiv. to the existence of a potential barrier of 3460 g.-cal. hindering the internal rotation of each Me group.
W. R. A.

New phenomena in liquid helium. J. D. COCKCROFT (Proc. Roy. Inst., 1939, **30**, 800—813).—A lecture.

Density and compressibility of solid hydrogen and deuterium at 4·2° K. (MISS) H. D. MEGAW (Phil. Mag., 1939, [vii], **28**, 129—147).—An extended account of work previously reported (cf. A., 1936, 1330). d and κ of H_2 and D_2 are 0·0890±0·0004 and 5·0±0·5×10^{-4}, and 0·2059±0·0010 and 3·3±0·7 × 10^{-4}, respectively (d at 0 kg. per sq. cm. and κ at average of range 0—100 kg. per sq. cm.). C. R. H.

Kinetic theory of gases. I. R. N. PEASE (J. Chem. Educ., 1939, **16**, 242—247).
L. S. T.

Elementary theory of condensation. F. CER-NUSCHI and H. EYRING (J. Chem. Physics, 1939, **7**, 547—551).—A new theory of crit. phenomena in liquids is based on the assumption of the presence of holes in a lattice-like structure. The treatment gives a theoretical curve for the ρ of vapour and liquid as a

function of temp. in agreement with the experimental curve. W. R. A.

Vapour pressure and rate of evaporation of barium oxide. J. P. BLEWETT, H. A. LIEBHAFSKY, and E. F. HENNELLY (J. Chem. Physics, 1939, 7, 478—484).—$BaCO_3$ or $Ba(OH)_2$ was heated slowly in vac. in a Pt crucible covered by a closely fitting Pt lid with a central small hole (diameter 93 mils), until decomp. to BaO was complete, high-frequency induction being used as the source of heat. The temp. was then raised to the evaporating temp. required and maintained there for a definite time (15—60 min.). Oxide vapour escaped through the hole in the lid, was condensed on the inside surface of an inverted Pyrex beaker, and determined as $BaSO_4$. The graph of log m ($m = $ g. per sq. cm. per sec.) against $1/T$ closely resembles that of Claassen and Veenemans (cf. A., 1933, 344). The rate of evaporation was determined also by a second method, which consisted in evaporating BaO from a special Mo furnace crucible (described) through a small hole. Analyses were made as before. The data (1526—1800° K.) agree with that from the first method. The v.p. of BaO is given by $\log_{10} p$ (mm. Hg) = $8\cdot63 - 19,400/T$ (1200—1800° K.), and the heat of sublimation is 88,000 g.-cal. W. R. A.

Influence of pressure on the thermal conductivity of liquid He II. J. F. ALLEN and E. GANZ (Proc. Roy. Soc., 1939, A, 171, 242—250).—The thermal conductivity has been measured in the temp. range 1·2—2·2° K. at pressures up to 25 atm. The pressure coeff. of conductivity is negative above 1·63° K. and positive below that temp. The conductivity of solid He was found to be about 10^{-3} times that of liquid He II. It is concluded that the flow of heat in liquid He II is due to some form of mass transfer other than that due to convection currents set up by density differences in the liquid. An explanation of the change of sign of the pressure coeff. is advanced. G. D. P.

Superfluidity of liquid helium II. J. FRENKEL (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 21—23).—The explanation of superfluidity (extremely small viscosity) of liquid He II offered by London and Tisza, based on Einstein's theory of the degeneracy of an ideal Bose gas at low temp., is open to the objection that He cannot be regarded as an ideal gas. It should be treated as a substance with a regular arrangement of atoms, but differing from a crystal by a distortion of the layers of atoms. The phenomenon of viscosity is therefore replaced by plastic flow. The superfluidity of He II can be explained on this basis if it is assumed that its elastic limit is zero, and that it is not hardened by the process of plastic slipping. A. J. M.

Viscosity of gases at high temperatures. G. RIBAUD and V. VASILESCO (Compt. rend., 1939, 208, 1884—1886).—Two flow methods are described for obtaining comparative vals. of η at 0—1600°, using a coiled 0·5-mm. Pt capillary 1 m. long. Vals. of Sutherland's const. for air (113—124), N_2 (110—120), A (142·3—168) (all at 0—1600°), and CO_2 (254—307 at 0—1400°) are deduced. A. J. E. W.

Relation between fluidity, temperature and chemical constitution of pure liquids. E. C. BINGHAM and S. D. STOOKEY (J. Amer. Chem. Soc., 1939, 61, 1625—1630).—The equation $\phi/T = a + bT + \ldots$ (i) [$\phi = $ fluidity in rhes (reciprocal poise), $T = $ ° K.] expresses accurately the fluidity data for a large no. of liquids, and shows deviations only for liquids containing an OH radical. a is const. for all members of a non-associated homologous series; b is an exponential function of the mol. wt. within a given series. These facts allow a second equation, $\phi/T = A_s + \alpha T \cdot 10^{\beta/M - \gamma/M^2}$ (ii), to be derived which expresses the fluidity–temp. relations of all the members of a series. The % deviation from (ii) increases gradually with increasing mol. wt. This equation has been successfully applied to data on numerous compounds but shows anomalies, as (i), with OH-compounds. Although the aliphatic acids obey equation (i) fairly well (due probably to the formation of almost stable association complexes), the lines given by $T-\phi/T$ for successive members are randomly placed and show variable slopes. The lines $T-\phi/T$ for alcohols are curved, due to irregular association which varies with temp. The plot of $T-\phi/T$ for H_2O is a straight line from 0° to 25°, and from 25° to 100°, curving slightly at 25°. W. R. A.

Viscosity function. II. Viscosity and constitution. E. P. IRANY (J. Amer. Chem. Soc., 1939, 61, 1734—1739).—In certain liquids "association" is postulated and the question of whether η should be correlated to the strength of intermol. binding forces or to the vol. change due to "association" is considered. Association factors are fractional nos. because of the presence of several mol. species and equilibria between these species should be sensitive to temp. variation. The association factors as deduced from empirical rules of constitutionally additive η are not real; most liquids are not associated and the rules thus amended are wrong. Intermol. forces must be included in the concept of constitution and the presence of different mol. species in an "associated" liquid will be revealed by the deviation from linearity of curves drawn on the graphical method of functional scales (A., 1938, I, 610). From consideration of the equation of the liquid state it is concluded that no rule of constitutive η can be generally valid unless it postulates two independent parameters and thus supposedly additive at. consts. of η can not be specified. In high-polymeric homologous series one parameter is const. and the other is constitutionally additive. Various series show behaviour in agreement with this view. W. R. A.

Dependence on temperature of the viscosity of melts. E. JENCKEL (Z. physikal. Chem., 1939, 184, 309—319).—Theoretical. Two η-T formulæ have been derived and the simpler of them is successfully applied to η data. C. R. H.

Effect of laminar and turbulent flow on the X-ray diagram of water and nitrobenzene. Contribution of X-rays to the problem of turbulent flow. W. DUBS (Helv. Phys. Acta, 1939, 12, 169—228).—The flow of liquids in tubes has been investigated by a visual and an X-ray method, with

particular regard to the transition from laminar to turbulent flow. X-Ray diagrams of H_2O and $PhNO_2$ showed little difference for the two states of flow. A. J. M.

Viscosity of ideal mixtures. G. P. LUTSCHINSKI (J. Phys. Chem. Russ., 1938, **12**, 680—681).—A reply to Batschinski (A., 1938, I, 567). J. J. B.

Separation of gases by thermal diffusion. L. J. GILLESPIE (J. Chem. Physics, 1939, **7**, 438, 530—535).—Mathematical. Simple equations are derived for the separation of the components of gas mixtures by thermal diffusion. The equation for a binary mixture gives an upper limit which is in agreement with or slightly > the observed val. Agreement is less satisfactory for mixtures containing H_2 and for very low temp. The separation of heavy species present in a complicated mixture is facilitated by addition of a light gas. W. R. A.

Isotherms of methane–ethane mixtures at 0°, 25°, and 50° up to 60 atmospheres. A. MICHELS and G. W. NEDERBRAGT (Physica, 1939, **6**, 656—662; cf. A., 1936, 1058).—p, d, and pv/RT vals. are recorded for mixtures containing $\sim$20, 40, 60, and 80 mol.-% of C_2H_6. The technique of the measurements is outlined. A. J. E. W.

Leakage of helium through Pyrex glass at room temperature. III. G. P. BAXTER (J. Amer. Chem. Soc., 1939, **61**, 1597; cf. A., 1931, 929).—The rate of leakage of He through Pyrex glass at room temp. has been determined by measuring the loss in wt. of a sealed globe containing He at a pressure originally slightly < atm. Data are recorded for observations extending over 11 years. W. R. A.

Diffusion of hydrogen and deuterium through iron. II. A. GÜNTHER-SCHULZE and A. WINTER (Z. Physik, 1939, **112**, 648—653; cf. A., 1939, I, 193).—Traces of O_2 reduce the diffusion of H_2 through Fe very considerably and must be removed by keeping P_2O_5 in the discharge tube. The influence of admixture of A, Ne, and He, which behave similarly, on the rate of diffusion of H_2 is examined. Obstruction of the Fe with A occurs at 1171 v. with 55% A and at 2157 v. with 20% A; at 273 v. obstruction is almost non-existent. A choked Fe plate becomes permeable again after about 10 hr. at room temp., indicating a slow diffusion of inert gas ions in the Fe. L. G. G.

Thermal conductivity of liquids. D. S. DAVIS (Chem. Met. Eng., 1939, **46**, 356—357).—Nomographs are presented summarising the data on the thermal conductivity of $MeOH$–H_2O, $EtOH$–H_2O, and glycerol–H_2O mixtures. F. J. B.

Properties of saturated aqueous solutions of potassium chloride at temperatures above 250°. M. BENEDICT (J. Geol., 1939, **47**, 252—276).—Equilibrium pressures of the system solid KCl–aq. solution–vapour have been determined between 250° and 600°. A max. pressure of 225 atm. found at 565° affords evidence that crit. phenomena do not occur in aq. solutions saturated with KCl. The sp. vol. of solid KCl and the apparent vol. of H_2O in the saturated solution have also been determined. The sp. vol. of

the liquid phase and the vol. change and latent heat in the reaction H_2O vapour + solid KCl $\to$ saturated liquid solution have been evaluated. L. S. T.

Properties of electrolytes in mixtures of water and organic solvents. I. Hydrochloric acid in ethyl alcohol– and *iso*propyl alcohol–water mixtures of high dielectric constant. H. S. HARNED and C. CALMON (J. Amer. Chem. Soc., 1939, **61**, 1491—1494).—The effects of different solvent mixtures on the thermodynamic properties of strong electrolytes have been investigated by measuring the e.m.f. of the cells $H_2|HCl$, solvent, $H_2O|AgCl$-Ag in mixtures containing 10 and 20% EtOH and 10% $Pr^\beta OH$ at 25° for [HCl] from 0·005 to 2M. The variation of the standard potential of the cells, evaluated with an accuracy of $\pm$0·05 mv., is discussed as a function of 1/dielectric const. for the above mixtures and for $MeOH$–H_2O, glycerol–H_2O, and dioxan–H_2O mixtures. W. R. A.

Construction of a 10-kw. rotating-anode X-ray tube, and investigation of the structure of salt solutions. J. BECK (Physikal. Z., 1939, **40**, 474—483).—An X-ray tube with an input of 10 kw. is described. It has been used to obtain X-ray scattering diagrams of solutions of LiCl, LiBr, and RbBr up to high concns. The arrangement of ions in the solution is not irregular, but the results may be explained if it is assumed that the H_2O has a lattice structure into which the ions fit. At higher concns. the lattice structure is similar to that of the hydrated salt. The concn. at which the formation of the lattice occurs varies from one salt to another and can be deduced from the photometer curves.

A. J. M.

Diffusion velocity and mol. wt. I. Limits of validity of the Stokes–Einstein diffusion equation. L. FRIEDMAN and P. G. CARPENTER. **II. Effect of p_H on particle size in gelatin solutions.** L. FRIEDMAN and K. KLEMM (J. Amer. Chem. Soc., 1939, **61**, 1745—1747, 1747—1749).—I. By using the Stokes–Einstein diffusion equation the mol. wts. of simple non-electrolytes can be calc. from diffusion coeffs. (D) at infinite dilution determined (1) by examining the vals. of D recorded in " International Critical Tables " (mannitol, lactose, maltose, sucrose, salicin), or (2) by an experimental study of diffusion (glucose).

II. The effect of p_H (0·05 to 6·4) on the D of 3% gelatin solution has been studied at 25°. Between p_H 2 and 6·4 D is almost const., indicating an approx. const. particle size. Below p_H 2, however, there is a rapid decrease in particle size. Addition of KCl to the gelatin solution at different p_H decreases D.

W. R. A.

Viscosity of aqueous solutions of strong electrolytes. VI. Viscosity of concentrated aqueous salt solutions containing uni- and bivalent cations, and the homogeneous equilibrium of reciprocal salt pairs. H. TOLLERT and J. D'ANS (Angew. Chem., 1939, **52**, 472—476).—η and ρ data at 20°, 30°, 50°, and 80° for conc. solutions of inorg. K, Na, NH_4, Ca, and Mg salts and mixtures thereof are recorded, and η and fluidity polytherms for several solutions are reproduced. The application of the

data to the elucidation of equilibrium conditions in mixed salt solutions is discussed.   C. R. H.

Coefficient of expansibility of aqueous solutions of carbamide at 27·5° calculated from the densities at 25° and 30°. F. J. GUCKER, jun., and C. E. MOSER (J. Amer. Chem. Soc., 1939, 61, 1558—1559).—A method has been developed mathematically for calculating the coeff. of expansion of any solution for which d is known as a function of the molarity m at two temp. Equations can also be derived for the apparent and partial mol. expansibilities. The method has been applied to $CO(NH_2)_2$ solutions at 27·5° from known vals. of d at 25° and 30°. The apparent mol. expansibility of $CO(NH_2)_2$ is $\simeq$ that of a uni-univalent electrolyte, although it is $\propto m$ and not to $m^{\frac{1}{2}}$.   W. R. A.

Fluorescing power of uranine solutions as a function of their hydrogen-ion concentration. A. BOUTARIC and (MME.) M. ROY (Compt. rend., 1939, 209, 162—164).—Measurements on buffer solutions (p_H 4·6—10) containing 0·5 g. of uranine per l. show that the fluorescing power first increases with rising p_H, and becomes const. at $p_H > 8·6$. Resorcinol has an inhibiting action on the fluorescence of uranine, independent of its effect on the p_H of the solution.
                                                                A. J. E. W.

X-Ray study of boric oxide–silica glass.—See B., 1939, 826.

Fine structure of glasses. II. E. KORDES (Z. physikal. Chem., 1939, B, 43, 119—152; cf. A., 1939, I, 250).—A no. of glass systems [binary: P_2O_5–PbO, B_2O_3–Na_2O; pseudo-binary: $MgSiO_3$–$CaSiO_3$, $Pb_3(BO_3)_2$–Pb_2SiO_4, $CaSiO_3$–Na_2SiO_3, $CaSiO_3$–$Na_2Si_2O_5$, $NaAlSi_3O_8$–$CaAl_2Si_2O_8$] are discussed in which the mol. refraction can be calc. from the const. refraction increments of the participating atoms. These exceptions can be predicted on the basis of their special structure or polarisation effects. The mol. vol. of binary acid glasses (SiO_2 and P_2O_5) can be calc. on the basis of structural considerations from the mol. vols. of pure SiO_2- or pure P_2O_5-glasses and the ionic radii of the different atoms. The dependence of the mol. vol. of binary glasses on the composition is illustrated by reference to the systems B_2O_3–Na_2O, SiO_2–Na_2O, SiO_2–PbO, and P_2O_5–PbO.
                                                                W. R. A.

A fluorite lattice with vacant anion places. E. ZINTL and U. CROATTO (Z. anorg. Chem., 1939, 242, 79—86).—La_2O_3 takes very little, if any, CeO_2 into solid solution, but CeO_2 forms mixed crystals of CaF_2 structure with $\not> 44$ mol.-% of La_2O_3. The saturated mixed crystals have a 5·587 A. From vals. for ρ, and from the intensities of the X-ray lines, the mixed crystal formation is of the substitution type, with vacant spaces in the anion lattice, i.e. $1CeO_2$ is replaced by $0·5$ La_2O_3.   F. J. G.

Solid solutions in the system zinc sulphide–manganese sulphide. F. A. KRÖGER (Z. Krist., 1939, 100, 543—545).—Despite chemical and structural similarities in ZnS and MnS favouring solid solutions. at room temp. the series is interrupted between 89 and 20 mol.-% MnS (Schnaase, A., 1933, 341). The products obtained by heating ppts. of

ZnS and green NaCl-type MnS (with KCl) at 800—1200° in an inert atm. have been analysed chemically and by precision powder X-radiograms. Heating at 1180° yields orange photoluminescent solid solutions of hexagonal wurtzite structure up to 52 mol.-% MnS with a a linear function of composition; above this, green MnS separates as a second phase. Below the transition point for ZnS (1020°) solid solutions of wurtzite- or sphalerite-type or both are obtainable, MnS lowering the transition point and producing a range of coexistence for the two phases.   I. McA.

Systems nickel ferrite–magnesium ferrite, nickel ferrite–copper ferrite, and nickel ferrite–zinc ferrite. H. FORESTIER and (MLLE.) M. VETTER (Compt. rend., 1939, 209, 164—167).—The variation of the Curie temp. (Θ) with the composition of the ferrite mixtures prepared by heating the pptd. mixed hydroxides at 1000° (Mg, Cu) or 850° (Zn) is studied. The mixtures give continuous series of solid solutions. A slight peak occurs in the Θ curve with equimol. proportions of NiO,Fe_2O_3 and MgO,Fe_2O_3 or CuO,Fe_2O_3, suggesting the existence of a superlattice containing alternate Ni and Mg (or Cu) atoms. Θ for the third system falls sharply with $<60\%$ of ZnO,Fe_2O_3 and cannot be determined with high contents; ZnO,Fe_2O_3 is thus paramagnetic. X-Ray diagrams show regular variations of the cryst. parameters, but the spinel structure persists throughout.
                                                                A. J. E. W.

Constitution and microstructure of copper-rich silicon–copper alloys. C. R. SMITH (Amer. Inst. Min. Met. Eng., Tech. Publ. 1073, 1939, 17 pp.; Met. Tech., 1939, 6, No. 4).—By microscopical examination of quenched samples the domain of the κ phase adjacent to α in the Cu–Si system has been determined. It is formed by peritectoid reaction of α and β at 842° and then contains 5·9 wt.-% Si ($=Cu_7Si$). It decomposes eutectoidally at 552°, when it contains 5·2% Si ($=Cu_7Si$). On the Si-rich side it extends to 6·85% ($=Cu_6Si$) at 785° and 6·95% Si at 729°. The max. extent of the α-phase is to 5·3% at 842°, decreasing to 4·65% ($=Cu_9Si$) at 552° and less at lower temp. Unusual microstructures are observed in the $\alpha + \kappa$ field, for the two phases exist as twin-like plates and do not spheroidise even when grain growth occurs following working and long annealing. The decomp. of κ to $\alpha + \kappa$ at $<552°$ is very slow unless the samples are cold-worked.   R. B. C.

Equilibrium diagram of the copper–antimony system. III. Transformations in the solid state. T. MURAKAMI and N. SHIBATA (Sci. Rep. Tôhoku, 1939, 27, 459—484; cf. A., 1939, I, 138).—Transformations in the solid state of Cu-Sb alloys have been investigated by differential dilatometric and electrical resistance methods. The equilibrium diagram has been revised to include a θ phase which is formed at 58·95% Cu at 440°.   D. F. R.

Transformations in copper–palladium alloys. F. W. JONES and C. SYKES (J. Inst. Metals, 1939, 65, Advance copy, 349—363).—The equilibrium diagram has been determined by X-ray examination of slowly cooled alloys and resistivity measurements during heating and cooling. Alloys with 8—18 at.-%

Pd have a Cu_3Au type of superlattice on slowly cooling and appear to contain anti-phase nuclei; their behaviour is similar to that of Cu_3Au. Cu_3Pd, however, has a tetragonal structure and its ordering process is more complicated than that of Cu_3Au, the sp. heat–temp. and temp. coeff. of resistance–temp. curves of the slowly cooled alloy show max. at $400°$, and the disorder–order transformation is very sluggish and is accompanied by marked grain refinement. The α' face-centred cubic phase with superlattice exists over a range from 8 to 18 at.-% Pd up to about $500°$, the tetragonal Cu_3Pd phase from 18 to 27 at.-% Pd up to about $450°$, and the body-centred cubic β phase from about 36 to 47 at.-% Pd up to $598°$; the β-phase region is surrounded by an $\alpha + \beta$ area which becomes narrower with rise in temp. and disappears at $598°$.　　A. R. P.

X-Ray study of silver–cadmium alloys. E. A. OWEN, J. ROGERS, and J. C. GUTHRIE (J. Inst. Metals, 1939, **65**, Advance copy, 231—246).—The system contains the following phases : α, Ag-rich solid solution; β, body-centred cubic, decomp. on cooling into ζ, close-packed hexagonal; γ, body-centred cubic, 52 atoms per unit cell; δ, close-packed hexagonal; ε, Cd-rich solid solution. The β-transformation occurs at $427°$ in alloys with 56·3—50% Ag ($\alpha + \beta$ range) and at $445°$ in alloys with 44·7—40·5% Ag ($\beta + \gamma$ range); pure β alloys transform into ζ at temp. between $427°$ and $445°$ according to the composition and there is a very narrow $\beta + \zeta$ field separating the pure β and pure ζ fields. The boundary compositions (% Ag) are as follows : α–($\alpha + \beta$) 56·5% at $450°$, 59·1% at $600°$, and 61·6% at $700°$; α–($\alpha + \zeta$) ~56·5% at 200—400°; ($\alpha + \beta$)–β 50·4% at $450°$, 53·6% at $600°$, and 54·9% at $650°$; ($\alpha + \zeta$)–ζ 49·1—49·7% at 200—400°; β–($\beta + \gamma$) 44·7—43·7% at 450—600°; ζ–($\zeta + \gamma$) 46—45% at 200—400°; ($\beta + \gamma$)–γ 40·4% at 450—600°; ($\zeta + \gamma$)–γ 40·4% at 150—400°; γ–($\gamma + \delta$) 37·2—37·9% at 150—600°; ($\gamma + \delta$)–δ 31·4—33% at 150—600°; δ–($\delta + \varepsilon$) 17·4% at 150—300°; ($\delta + \varepsilon$)–ε 3—6·1% at 100—300°. The γ-phase alloys are very brittle but β alloys quenched from $600°$ are plastic. The inclination of the ε–($\delta + \varepsilon$) boundary to the vertical indicates that the solid solubility of Ag in Cd at room temp. must be very small.
　　A. R. P.

Constitution of magnesium–zinc alloys. F. LAVES (Naturwiss., 1939, **27**, 454—455).—A new temp.–composition diagram for the Mg–Zn system, based on X-ray and microscopical investigations, is given. In addition to $MgZn_2$, homogeneous phases with the approx. compositions Mg_2Zn_3, MgZn, and Mg_7Zn_3 have been obtained. They give characteristic powder diagrams.　　A. J. M.

Structure of magnesium-rich magnesium–lead alloys. H. VOSSKÜHLER (Z. Metallk., 1939, **31**, 109—111).—The eutectic point is $466°$, 66·8% Pb; Mg dissolves 3·7% Pb at $100°$, 15% at $300°$, 40% at $440°$, and 46·2% at the eutectic temp., and the solidus line is slightly concave to the temp. axis.
　　A. R. P.

Longitudinal magneto-resistance effect at various temperatures in iron–cobalt alloys. Y. SHIRAKAWA (Sci. Rep. Tôhoku, 1939, **27**, 532—

560).—The change in resistance of the alloys of face-centred cubic γ solid solution is $\gg$ that of the alloys of body-centred cubic α solid solution on the Fe side and that of the hexagonal close-packed λ solid solution on the Co side, especially at low temp. In an alloy containing 90% Co the change is 3·8% at $-195°$ with a field of 1500 oersteds.　　D. F. R.

Longitudinal magneto-resistance effect at various temperatures in iron–nickel alloys. Y. SHIRAKAWA (Sci. Rep. Tôhoku, 1939, **27**, 485—531; cf. A., 1936, 1332; 1938, I, 569).—The change in resistance of the alloys of face-centred cubic solid solution on the Ni side is $\gg$ that of the alloys of body-centred cubic solid solution on the Fe side, especially at low temp. In an alloy containing 85% Ni the change is 12·8% at $-195°$ with a field of 1500 oersteds.　　D. F. R.

System iron–nickel–nickel titanide Ni_3Ti–iron titanide Fe_2Ti. R. VOGEL and H. J. WALLBAUM (Arch. Eisenhüttenw., 1938—9, **12**, 299—304).—The equilibria in the Ni–Ti system up to 30% Ti and in the Ni–Fe–Ti system between the Fe–Ni side and the Fe_2Ti–Ni_3Ti line have been determined by thermal analysis and micrographic examination. Ni_3Ti melts at $1378°$ and forms a eutectic with Ni at $1287°$, 16·2% Ti; Ni dissolves 10·8% Ti at $1250°$, 5% at $1050°$, and ~2·5% at $20°$. The Ni_3Ti–Fe_2Ti system has a eutectic point at $1320°$, Ni 41, Ti 25%, and Ni_3Ti dissolves about 18% Fe_2Ti. In the ternary system eutectic valleys run from these two eutectic points and from the Fe–Fe_2Ti eutectic point to the ternary eutectic at $1105°$, Ni 42, Ti 20%; in the solid state only four phases exist, viz., α- and γ-Fe and the two compounds, all as solid solutions the composition of which changes somewhat with the temp. Equilibrium diagrams and characteristic microstructures are given.　　A. R. P.

Crystal chemistry of alloys : system magnesium–copper–silicon with particular reference to the section $MgCu_2$–$MgSi_2$. H. WITTE (Metallwirts., 1939, **18**, 459—463).—Alloys of compositions lying on the line $MgCu_2$–$MgSi_2$ and containing 0—55% $MgSi_2$ have been investigated thermally, microscopically, and by X-rays. Between 0 and 35% $MgSi_2$ there is a series of solid solutions with structures of the $MgCu_2$, $MgNi_2$, and Mg_2Cu_3Si types. The phase at the composition Mg_2Cu_3Si undergoes a transformation at 870—890°, to a structure of the $MgNi_2$ type. A compound $Mg_6Si_7Cu_{16}$, having a face-centred cubic translation lattice, has been identified.　　C. E. H.

Age-hardening of aluminium alloys.—See B., 1939, 844.

X-Ray study of slowly cooled iron–copper–aluminium alloys. II. Alloys rich in aluminium. A. J. BRADLEY and H. J. GOLDSCHMIDT (J. Inst. Metals, 1939, **65**, Advance copy, 195—210; cf. A., 1939, I, 314).—The equilibria in the section of the Fe–Cu–Al system between the Al corner and the line joining the 50 at.-% Fe point on the Fe–Al side with the 50% Cu point on the Cu–Al side are complex; there are 14 single-phase areas, 10 of which are derived from the binary Fe–Al and Cu–Al systems and 4 are ternary solid solutions approximating to the

formulæ $FeCu_{10}Al_{10}$ (ϕ), $FeCu_{10}Al_{18}$ (χ), $FeCu_2Al_6$ (ψ), and $FeCu_2Al_7$ (ω). The phases derived from the binary Cu–Al system are : α (Cu-rich solid solution); γ (Cu_9Al_4) complex cubic; γ_1 ($Cu_{32}Al_{19}$) deformed γ structure; γ_2 (Cu_3Al_2) deformed γ-structure; ζ_2 (Cu_4Al_3) monoclinic; η_2 (CuAl) orthorhombic; θ ($CuAl_2$) tetragonal; κ (Al-rich solid solution). The phases derived from the binary Fe–Al system are : λ_1 (Al_7Fe_2) orthorhombic; μ (Al_5Fe_2) monoclinic; ν (Al_2Fe) monoclinic; β_2 (AlFe) and β_1 ($AlFe_3$) both body-centred cubic with superlattice. Between these small single-phase areas are 29 two-phase and 16 three-phase fields many of which are very long and narrow. The solubility of Cu in Fe at room temp. increases from 0·5% at 0% Al to 5% at 27 at.-% Al and 10% at 36 at.-% Al. The γ phase is in equilibrium with α, β_1, and β_2 and dissolves a max. of 2% Fe, the ϕ phase is in equilibrium with ζ, η, ω, ψ, β_2, and γ_2, the ν phase has a narrow composition range and forms two-phase fields only with β_2 and μ, the μ phase dissolves up to 5% Cu, and λ_2 is in equilibrium with ω, ψ, β_2, and ν. Of the ternary phases ω is in equilibrium with κ, θ, λ_1, λ_2, ψ, χ, η, and θ, and χ with η, β, and ω. A. R. P.

Equilibrium between liquid and gas at high pressures and temperatures. IV. Solubility of air in water and in sodium hydroxide solutions of various concentrations. M. I. LEVINA and N. P. STZIBAROVSKAJA (J. Phys. Chem. Russ., 1938, **12**, 653—659).—Vals. are recorded for the solubility of air, N_2, and O_2 at 100 kg. per sq. cm. between 0° and 240°. The solubility in H_2O shows a min. at 75°; additions of NaOH decrease the solubility and flatten the min. so that in 4N-NaOH the solubility is almost independent of the temp. J. J. B.

Demonstration of an inverted solubility curve. K. A. KOBE (J. Chem. Educ., 1939, **16**, 183 ; cf. A., 1937, I, 560).—A solution of $MnSO_4$, saturated at 27° and containing 0·5% H_2SO_4 to prevent hydrolysis, is immersed in a freezing mixture, when crystals of $MnSO_4,7H_2O$ soon appear. On heating, the solution becomes clear, and, at the b.p., $MnSO_4,H_2O$ crystallises out. L. S. T.

Use of radio-cobalt for the determination of the solubility of its tervalent salts with α-nitroso-β-naphthol and β-nitroso-α-naphthol. B. N. CACCIAPUOTI and F. FERLA (Annali Chim. Appl., 1939, **29**, 166—169 ; cf. A., 1939, I, 315).—Using radioactivity technique, the solubilities of the two above-mentioned salts are found to be 1·5 and 0·17 mg. per l., respectively, under the usual analytical conditions. O. J. W.

Mechanism of cation exchange in the montmorillonite–beidellite–nontronite type of clay minerals.—See A., 1939, I, 498.

Occlusion and evolution of hydrogen in pure iron.—See B., 1939, 832.

Gas flow in solids. R. M. BARRER (Phil. Mag., 1939, [vii], **28**, 148—162).—Mathematical. Gas flow by diffusion in combination with phase-boundary processes corresponding with transfer from a gas phase through an adsorbed layer into a solid and vice versa is considered. Surface processes can influence permeability to a considerable extent and large concn. discontinuities at the surfaces are possible. C. R. H.

Diffusion in absorbing media. P. S. H. HENRY (Proc. Roy. Soc., 1939, A, **171**, 215—241).—A mathematical investigation of the problem of diffusion of one substance through another in the pores of a solid body which absorbs and immobilises some of the diffusing substance. The evolution of heat which accompanies the absorption process affects the absorbing power of the solid. The problem arose in connexion with the uptake of moisture by cotton bales, but the theory is also applicable to the case of a dissolved substance diffusing through a gel. G. D. P.

Ageing and formation of precipitates. XXIX. Thermal ageing and abnormal physical properties of fresh silver bromide. I. M. KOLTHOFF and A. S. O'BRIEN (J. Chem. Physics, 1939, **7**, 401—404).—The degree of ageing and of perfection of freshly pptd. AgBr has been followed by measuring the decrease of sp. surface as indicated by the amount of wool-violet adsorbed on the surface saturated with the dye, and by determining the speed of penetration of radioactive Br′ into the inactive ppt. The decrease in sp. surface is initially rapid, and for 0·001M-$AgNO_3$ in H_2O, EtOH, and C_6H_6, the rate is not affected by the solvent, and is that of a ppt. kept in the air-dried state at 25°. During the ageing the speed of penetration of radioactive Br′, measured by shaking the ppt. with radioactive Br in EtBr, decreases. In fresh air-dried AgBr a rapid exchange occurs between Br′ and radioactive Br dissolved in EtBr or Br in the gaseous state. The relatively large electrical conductivity of fresh AgBr indicated by the great thermal mobility is at least partly ionic. W. R. A.

Adsorption by an insoluble substance which is formed in the solution of the adsorbent. G. ROSSI and M. RAGNO (Annali Chim. Appl., 1939, **29**, 135—146 ; cf. A., 1933, 774).—Measurements have been made of the adsorption of various dyes from aq. solution by $BaCO_3$ (a) produced by pptn. in the solution and (b) suspended directly in the solution. The adsorption curves are markedly different in the two cases, and indicate two different types of adsorption. O. J. W.

Adsorption in metallic solution. L. CONVERS (J. Chim. phys., 1939, **36**, 175—189 ; cf. A., 1936, 142, 423).—Surface tensions (γ) have been measured by the drop-wt. method for Hg in air (max. 494 dynes per cm.) and in a vac. (417—442), and for dil. amalgams of alkali and alkaline-earth metals in a vac. The difference in the vals. of γ for Hg in air and in a vac. is ascribed to an adsorbed layer of O_2 followed by slow oxidation in the former case, or to surface orientation of Hg atoms in the latter. The γ-concn. curves for the amalgams have two descending branches connected by an ascending branch. These are explained in terms of adsorption and orientation of the solute and of aggregations of Hg and solute. The existence of a rigid film at the surface of the amalgams is noted. F. L. U.

Adsorption of ascorbic acid by lead salts. N. L. LAHIRY and M. SREENIVASAYA (Current Sci.,

1939, **8**, 257—258).—$PbSO_4$ formed by the addition of $Pb(OAc)_2$ to an alcoholic solution of ascorbic acid (I) acidified with H_2SO_4 removes (I) in an amount dependent on p_H (optimum $p_H \sim 3.9$).   L. S. T.

Chromatographic adsorption and dipoles. R. T. ARNOLD (J. Amer. Chem. Soc., 1939, **61**, 1611—1612).—A survey of recorded data has revealed the importance of dipoles in determining the order of adsorption of a mixture on a polar medium. Basicity and acidity of the compounds are not important factors. The no. of isolated dipoles in a mol. is an important factor; picric acid (3 NO_2-groups) is more strongly adsorbed on Al_2O_3 from C_6H_6–light petroleum solutions than is o-$PhNO_2$, although the latter has the larger permanent dipole. Of isomeric mols. containing the same no. and kind of functional groups, those with the larger dipole moment are the more strongly adsorbed on polar media. Where no permanent dipole exists those components with highest polarisability should be the most strongly adsorbed.
    W. R. A.

Adsorption of pigments. Specific surface of some zinc oxides. W. W. EWING (J. Amer. Chem. Soc., 1939, **61**, 1317—1321).—The adsorption of Me stearate (I), glycol dipalmitate (II), and glycol tristearate (III) from C_6H_6 solutions by five ZnO pigments (very fine to coarse) has been investigated. Comparison of the data for (I) and (II) indicates that they are adsorbed in the same manner on the solid surface and that the area occupied by the two-chain mol., (II), is $\sim$ twice that occupied by the one-chain mol., (I). Both films are unimol. (or some integral multiple). The amounts of adsorption of the three-chain mol. (III) and stearyl alcohol in conc. solutions are $\geqslant$ than expected vals., and vary with the solute concn. The mechanism of adsorption of (III) probably differs from that of (I) and (II). The sp. surfaces of the pigments calc. from adsorption data agree with those calc. by the photomicrographic method.
    W. R. A.

Adsorptive properties of synthetic resins. II. Adsorption of potassium salts of various anions. S. S. BHATNAGAR, A. N. KAPUR, and M. S. BHATNAGAR (J. Indian Chem. Soc., 1939, **16**, 249—257; cf. A., 1937, I, 234).—Adsorbabilities of various anions of K salts on a resin prepared by acid condensation of CH_2O with m-$C_6H_4(NH_2)_2$ are in the following order : $Cl' > Br' > I'$; $HCO_2' > OAc' > PrCO_2'$; $C_2O_4'' > CH_2(CO_2)_2'' > (\cdot CH_2 \cdot CO_2)_2'' >$ adipate ; $MnO_4' > ClO_3' > BrO_3' > IO_3' > CNS'$; $Fe(CN)_6''' > Fe(CN)_6''''$; $Cr_2O_7'' > CrO_4'' > S_2O_3''$. For many of these series the order of adsorbability is the reverse of the order of solubility, but account must also be taken of the size of the anion; $e.g.$, $PhSO_3H$ is both more sol. and more adsorbable than p-$NH_2 \cdot C_6H_4 \cdot SO_3H$.
    W. R. A.

Adsorption phenomena at interfaces. M. AUBRY (Compt. rend., 1939, **208**, 2062—2064).—Trillat's method of studying the variation of the interfacial tension (σ) with time is improved by the use of CCl_4 instead of vaseline oil, as steady conditions are reached more rapidly. Cyanine in aq. solution may be determined by measuring σ after a fixed time of contact with CCl_4; the adsorption of cyanine at the interface follows the Freundlich isotherm ($n = 0.22$).   A. J. E. W.

Mechanical properties and stabilising effect of adsorbed layers as a function of their degree of saturation. I. P. A. REHBINDER and A. A. TRAPEZNIKOV (J. Phys. Chem. Russ., 1938, **12**, 573—582).—The rigidity of surface layers of saponin and of palmitic acid (I) in presence of multivalent cations increases with the degree of saturation of the surface layer. The life-time of a bubble under the H_2O surfaces coated by a monolayer shows a max. when the layer is not yet complete; oleic acid is more active than (I) or cetyl alcohol.   J. J. B.

Optical thickness of the transition layer between transparent media. H. D. BRUCE (Proc. Roy. Soc., 1939, **A**, **171**, 411—421).—The theories of Drude and of Maclaurin are shown to reduce to an identical form in which it is not possible to separate the thickness and refractive index of the transition layer.   G. D. P.

Potentials at oil–water interfaces. R. B. DEAN (Nature, 1939, **144**, 32).—Experiments on oil–H_2O potentials with protein films at the interface are described and discussed.   L. S. T.

Boundary surface solutions. H. DUNKEN (Z. physikal. Chem., 1939, **B**, **43**, 240—244).—A description of several old and new experiments on boundary surface solutions.   W. R. A.

Surface skin formation between a hot liquid and a cold wall. H. VON WARTENBERG (Z. Elektrochem., 1939, **45**, 497—502).—Experiments on the behaviour of fused salts, metals, H_2O, and oil in contact with various cooled surfaces indicate that liquids do not wet a surface which is cooled to a temp. below the f.p. of the liquid. Even in a high vac. a definite gap is formed between the cooled surface and the liquid or the crystals deposited from it. If the cooled surface is of the same material as the melt wetting may occur subsequently if the surface of the solid is fused. The wetting and non-wetting of the surface can be detected by the thermal conductivity between the melt and the cooled surface, which is decreased very considerably by the presence of the gap between the two phases.   J. W. S.

Energy relations in transformations from three- to two-dimensional systems. I. Latent heat and entropy of spreading of myristic and pentadecoic acids. W. D. HARKINS and G. C. NUTTING (J. Amer. Chem. Soc., 1939, **61**, 1702—1704). —Using the equation $\Delta H = \lambda_{S \rightarrow F} = T(\delta f/\delta T)(a_F - a_S)$ (f = film pressure at equilibrium between the crystals and the film, and a = area of the surface involved) the latent heats of spreading $\lambda_{S \rightarrow F}$ of crystals (S) of myristic (I) and pentadecoic (II) acids to form a film (F) on 0.01N-H_2SO_4 have been determined at different temp. The latent heat of spreading for (I) increases approx. linearly with the mol. area, rising from 6020 g.-cal. per mol. at 22·1 sq. A. per mol. to 8060 g.-cal. per mol. at 28·7 sq. A. per mol. The corresponding increment in entropy is from 14·5 to 18.9×10^{-16} erg per degree per mol. The latent heat of spreading for (I) (14 C) is $\sim$1000 g.-cal. per mol. $>$ that for (II) (15 C).   W. R. A.

Properties of unimolecular layers on salt solutions. I. A. I. PANKRATOV. II. A. N. FRUMKIN and A. I. PANKRATOV (J. Phys. Chem. Russ., 1938, **12**, 541—548, 549—555).—I. At a const. area the surface pressure and the surface potential of cetyl alcohol and Et palmitate (I) films increase when the underlying solution contains much (1—8 N.) salt. The effect of the salts rises in the series sulphates < chlorides < bromides < iodides.

II. The chemical potential of (I) on various underlying solutions is calc. The calculation makes it probable that the salt effect is due to interaction between the salt ions and the dipoles.   J. J. B.

Spreading of paraffin oils containing fatty acids on aqueous solutions of calcium ions. E. H. MERCER (Proc. Physical Soc., 1939, **51**, 561—565).—The spreading of drops of paraffin oil containing stearic acid on alkaline solutions of $CaCl_2$, during which acid mols. escape from the oil lens, is described; the influence of acid concn., alkalinity, and temp. on the amount of acid shed from the expanding oil drop is investigated, and the mechanism of spreading is discussed.   N. M. B.

Different physical states of protein layers. D. DERVICHIAN (Compt. rend., 1939, **209**, 156—158; cf. A., 1939, I, 317).—Below a certain crit. surface pressure (p 0·2—0·3 dyne per cm.), A-type protein films on H_2O exist in the gaseous state, in which the polypeptide and lateral chains of the mols. lie on the surface. Condensation (p >0·2—0·3 dyne) is not instantaneous, and slow compression of the film, in which two phases coexist, causes a steady increase of p. Condensation is accompanied at first by erection of the non-polar lateral chains (leucine type residues); at $p = \sim 1.5$ dyne the peptide groups become detached from the surface and the polypeptide chains become curved, while the polar groups on lateral chains remain on the surface. The film is fluid up to this stage, but at higher p gel formation occurs under the influence of mol. interactions; the elasticity of the gelified film is due to the extensibility of the buckled chains. B-type layers approximate to the normal three-dimensional state of the solid protein, and their high η is due to greater thickness and the cohesive effect of polar groups in the body of the film. B-films, which are disordered on formation, undergo progressive rearrangement on keeping, and tend towards the state of lowest energy. This accounts for the ageing effect. Successive extensions of B-layers increase the no. of polar groups on the surface, causing an apparent increase of mol. area.   A. J. E. W.

Interaction of polycyclic hydrocarbons with sterols in surface films.—See A., 1939, III, 763.

Electrical properties of multilayers. R. W. GORANSON and W. A. ZISMAN (J. Chem. Physics, 1939, **7**, 492—505).—A detailed account of work already noted (A., 1938, I, 615).   W. R. A.

Electrical properties of multimolecular films. H. H. RACE and S. I. REYNOLDS (J. Amer. Chem. Soc., 1939, **61**, 1425—1432).—The electrical properties of multimol. films (Ca, Pb, Ba, Cu, Cd stearates and Cd arachidate), formed by depositing monolayers on a clean polished Cr slide, have been measured with a clean dropping Hg electrode. The dielectric const. of the multilayers is 2·55±3% and is independent of the thickness and of the frequency up to 10^6 cycles per sec. The variation is due more to the p_H of the substrate (and thus to the proportion of acid to soap in the film), than to the metal. There is no apparent dependence of dielectric loss on frequency or film constitution. Variations in dielectric strength, which can be obtained as high as 2×10^6 v. per cm., are due probably to the presence of holes, cracks, or dust particles in the films. The electrical properties of skeletonised films agree with the concept of their physical structure.   W. R. A.

Surface properties of aqueous solutions of sodium salts of higher alkylsulphonic acids. W. KIMURA, S. NAKANO, and H. TANIGUCHI (J. Soc. Chem. Ind. Japan, 1939, **42**, 121—128B).—It has been established that these Na salts are quite stable in hot, strongly acid solution even at low concn. and show high capillary activity without any tendency to hydrolysis or turbidity.   T. H. G.

Liquid films. (SIR) W. H. BRAGG (Proc. Roy. Inst., 1939, **30**, 687—696).—A lecture.

Surface tension of equimolar solutions. C. SĂLCEANU and H. McCORMICK (Compt. rend., 1939, **208**, 1989—1991).—Measurements on a no. of non-electrolyte solutions show a γ increase of ~ 0.8 dyne per cm. per g.-mol. of solute per l. The increment is independent of the nature of the solvent or solute. Greater increments are given by electrolyte solutions owing to dissociation, the γ increase being $\sim 0.8 \times$ (no. of ions per mol. of solute).   A. J. E. W.

Kinetics of the mutual displacement of liquids from the pores of a porous body, and a characteristic of porosity. I. Mutual displacement of liquids in the absence of a meniscus. N. A. FIGUROVSKI (J. Phys. Chem. Russ., 1938, **12**, 619—633).—Charcoal was soaked in Et_2O and immersed in EtOH, and the alteration of its wt. with time was measured. Hence the pore size of the C was calc. Microscopical examination of the C shows that this calculation gives the correct order of magnitude.   J. J. B.

Fog and mist from the physico-chemical standpoint. J. C. PHILIP (Trans. Inst. Chem. Eng., 1938, **16**, 200—208).—The relationship between dusts, smokes, and fogs is outlined. The information derived from detailed chemical investigation of NH_4Cl fogs produced under controlled conditions indicates that the individual droplets can be smaller and the concn. of stable fogs higher than those suggested by previous workers. It is maintained that condensation of a supersaturated vapour depends on the formation of a sufficient no. of aggregates > a crit. size.   F. J. B.

Stability of emulsions. I. Soap-stabilised emulsions. A. KING and L. N. MUKHERJEE (J.S.C.I., 1939, **58**, 243—249).—Emulsion stability is defined as the reciprocal of the rate of increase of the interfacial area of 1 g. of the emulsified material. By means of size-frequency analysis, a large no. of soap-stabilised emulsions has been investigated. The

globules in these emulsions become larger with time. In homogenised emulsions, globules $> 7.5 \mu$. coalesce, and appear as free oil. The mechanical method of emulsification affects the degree of dispersion and the stability. The effect of added $CaCl_2$ or HCl is to increase the globule size and to decrease the stability. Soaps form fine, but not very stable, emulsions. The emulsifying efficiency decreases in the order, oleate $>$ stearate $>$ palmitate. NH_4 soaps are less efficient than those of Na and K.

Influence of electrolytes on formation of silver chloride sols. I. Coagulating effect of excess of chlorides and their mixtures. L. K. LEPIN and A. V. BROMBERG (J. Phys. Chem. Russ., 1938, **12**, 609—618).—$AgNO_3$ solutions were mixed with chloride solutions, and the concn. of the chloride giving the least turbid sol was determined. For MCl_2 this concn. is ~ 0.2 of that for MCl, whilst the respective coagulating concns. are in the ratio $1 : 50—1 : 100$. Mixtures of MCl and MCl_2 usually possess a smaller coagulating power than does either separately. This antagonistic action of uni- and bi-valent cations is even more pronounced in AgI sols.　　J. J. B.

Influence of freezing on the formation of structures in colloidal basic aluminium salts. E. I. KVIAT (J. Phys. Chem. Russ., 1938, **12**, 634—638).—Some $Al(OH)_3$ sols coagulate after being frozen. The viscosity (η) of sols having no definite structure is raised by freezing, whilst that of sols possessing abnormal η is lowered. The thixotropy of $Al(OH)_3$ sols is also affected by freezing.　　J. J. B.

Influence of freezing on the formation of structures in colloidal basic iron salts. E. I. KVIAT (J. Phys. Chem. Russ., 1938, **12**, 660—667).—When a $Fe(OH)_3$ sol has an abnormal viscosity (η), this is lowered by freezing and thawing; if the η is normal it is raised. $Fe(OH)_3$ shows the " kryotropy " of Prakash (cf. A., 1934, 363). The relation between kryotropy and thixotropy is discussed.　　J. J. B.

Surface tension and thixotropic properties of Putnam clay suspensions. J. W. BELTON (Proc. Leeds Phil. Soc., 1939, **3**, 565—568).—The surface tension of Putnam clay suspensions, measured by the bubble-pressure method, increases with time. The increase, due to thixotropy, is exhibited only by the fractions of the suspensions containing particles between 100 and 200 mμ.　　D. F. R.

Ion aggregation in solutions of long paraffin-chain salts. G. S. HARTLEY (Kolloid-Z., 1939, **88**, 22—40).—A survey of recent work.　　F. L. U.

Viscosity and density measurements and X-ray studies of soap solutions. K. HESS, W. PHILIPPOFF, and H. KIESSIG (Kolloid-Z., 1939, **88**, 40—51).—The crit. concn. (C_k) of micelle formation for Na salts of saturated fatty acids up to C_{12}, Na dodecyl sulphate, and Na oleate has been deduced from property-concn. curves. The vals. so obtained agree among themselves where comparison is possible, and with those afforded by X-ray examination. The results indicate that in aq. solution the soaps may exist as simple mols., very small or non-cryst. aggregates, or cryst. micelles.　　F. L. U.

Macromolecular compounds. CCVIII. Osmotic pressure of aqueous solutions of multivalent acids and their salts with uni- and bi-valent bases. W. KERN (Z. physikal. Chem., 1939, **184**, 302—308).—Osmotic pressure (Π) experiments previously reported (A., 1939, I, 417) have been extended to Li, Na, K, NH_4, and Me-, Et-, Bu^a-, and CH_2Ph-substituted NH_4 salts of a polyacrylic acid (degree of polymerisation 350). For such neutral salts Π is almost independent of the nature of the cation, although for the NH_4 bases there is a slight increase in Π with radical substitution. The $(CH_2 \cdot NMe_2)_2$ salt, used as an example of a salt with a bivalent base, shows marked differences from salts with univalent bases. The relation $\Pi = \alpha_k/(b + a\alpha_k)$ (α_k = relative cation concn., a and b consts.) holds for salts of univalent but not for those of bivalent bases, the Π-α_k curve being concave instead of convex to the Π axis. The osmotic coeff.-log α_k curves for the two kinds of salts also show wide differences. The data are discussed with reference to the buffering action of cations as in the earlier papers.　　C. R. H.

Dielectric investigations on solutions of fibrous molecules. I. SAKURADA and S. LEE (Z. physikal. Chem., 1939, B, **43**, 245—256; cf. A., 1935, 1319).—Identical solutions in C_6H_6 of mono- and poly-chloroprene, -vinyl acetate, and -styrene have been investigated dielectrically. The ratios of the dipole moments of the synthetic highly polymerised compounds to those of the corresponding monomerides are not only independent of the degree of polymerisation, but are also ~ 1. Thus fibrous mols. in solution are not rigidly extended, but are soft and flexible.　　W. R. A.

Influence of inorganic salts on properties of cellulose acetate solutions.—See B., 1939, 812.

Influence of neutral salts on the position of the isoelectric point of gelatin. A. PASSINSKI and I. PETROV (J. Phys. Chem. Russ., 1938, **12**, 556—568). —The rate of cataphoretic migration of the boundary between gelatin sol and gelatin sol + Au sol was measured, and from its dependence on the p_H the isoelectric point was calc. Small concns. of $BaCl_2$ shift this point from 5.06 to 5.4, whilst high $[BaCl_2]$ lowers it again. KCNS causes a lowering of the point to 4.90 followed by a rise at high [KCNS]. Ag_2SO_4 and a citrate–phosphate buffer are almost inactive.　　J. J. B.

Influence of the concentration of gelatin on the position of its isoelectric point. A. PASSINSKI and I. PETROV (J. Phys. Chem. Russ., 1938, **12**, 569—572). —The method previously described (cf. preceding abstract) was used to determine the isoelectric point of 0.2, 0.5, and 1% gelatin solutions, for all of which it was at p_H $4.74—4.76$.　　J. J. B.

Fractional solubility of gluten in sodium salicylate solutions.—See A., 1939, III, 869.

Equilibria in gels. F. MICHAUD (J. Chim. phys., 1939, **36**, 167—174).—Theoretical. The behaviour of gels, other than that due to short-term properties such as elasticity, is adequately accounted for by considering them as solutions of liquids in solids.

Syneresis represents separation of solute from a super-saturated solution. F. L. U.

X-Ray investigation of silicic acid gels. S. K. Dubrovo (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 50—53).—Silicic acid gels prepared by the action of HCl on a solution of Na silicate and by hydrolysis of $SiCl_4$, although of different p_H, have the same mol. structure, containing crystallites of β-cristobalite and tridymite of dimensions $<10^{-5}$ cm. When heated to 900—950° they give a diagram showing definite cryst. structure. The product from the gel obtained from $SiCl_4$ is a mixture of β-cristobalite and tridymite. The presence of 10% of $CuCl_2$ in the gels does not affect the cryst. structure, but with 10% of $BaCl_2$ crystallisation is favoured. A. J. M.

Physical chemistry of starch.—See B., 1939, 879.

Mechanism of deformation and fine structure of hydrous cellulose. IX. Theoretical relation between anisotropy of swelling and double refraction of oriented fibres. P. H. Hermans and P. Platzek. **X. "Kratky's chain" as quantitative model for the mechanism of deformation of hydrous cellulose gels.** P. H. Hermans and J. de Booys (Kolloid-Z., 1939, 88, 68—72, 73—78).—IX. Formulæ are derived for the relation between anisotropy of swelling and double refraction of oriented fibres, and between each of these quantities and the mean angle of orientation of the micelles.

X. The Kratky model is used as a basis for developing quant. relations between anisotropy of swelling and double refraction on the one hand and degree of extension on the other. F. L. U.

Effect of non-electrolytes on the time of setting of gelatin gels. L. Friedman and W. N. Shearer (J. Amer. Chem. Soc., 1939, 61, 1749—1751).—Addition of small concns. of non-electrolytes [sucrose, $CO(NH_2)_2$, fructose] increases the setting time of gelatin gels, the effect being max. at 0·02—0·03M. With concns. of non-electrolyte $>0·1$M. the gels set more rapidly than in absence of non-electrolyte. Comparison of the data with those obtained from a study of the effect of non-electrolytes on diffusion velocity in gelatin gels (cf. A., 1934, 842) indicates that the slower-setting gels have a more open structure. W. R. A.

Electrolyte coagulation of hydrophobic sols. W. Ostwald (Kolloid-Z., 1939, 88, 1—17).—The author's theory (A., 1936, 157 and later abstracts) of the relation between coagulation and activity coeff. is discussed and further experimental evidence is brought forward to show that the theory gives a satisfactory account of valency effects, ion antagonism, "irregular series," and the influence of temp. and change of dispersion medium. F. L. U.

Rhythmic precipitates. T. Isemura (Bull. Chem. Soc. Japan, 1939, 14, 179—237).—A comprehensive survey of the subject includes work previously reported (A., 1933, 346, 568; 1934, 840; 1935, 293; 1938, I, 514), and further experiments on the influence of various factors such as temp., gel concn., p_H, etc. A no. of new examples of rhythmic pptn. in gelatin and in SiO_2 gel are described. F. L. U.

Wave-like character of periodic precipitates. (Sir) C. V. Raman and K. S. Ramaiah (Proc. Indian Acad. Sci., 1939, 9, A, 455—466).—Theoretical. An extended account of work previously reported (A., 1938, I, 514). C. R. H.

Liesegang rings. K. S. Ramaiah (Proc. Indian Acad. Sci., 1939, 9, A, 467—478).—$AgCrO_4$ rings in gelatin are distinguished as primary and secondary, the latter being of very fine structure visible only under the microscope, and extending throughout the surface, whilst the former are superimposed at wider intervals on the latter, thereby strengthening them and making them visible. Primary rings conform to the outline of the central drop, but the secondary rings are more truly circular. The latter generally start nearer the centre than the former and cease only after all the former have been completed. The continuous structure of the secondary rings cannot be reconciled with the common view that they are due to impurities. Primary rings were not formed by AgCl or Ag_3PO_4 in gelatin nor were secondary rings by PbI_2 in agar. No general conclusions can be reached about the spacing of the rings, but Schleussner's law that the radii of the rings form a simple geometrical progression is a better approximation to the facts than Veil's which states that the square roots of the intercepts between successive rings form an arithmetical series. The closely spaced rings in many of the systems can act as diffraction gratings giving diffraction spectra. C. R. H.

Action of X-rays on the electrophoretic mobility of colloid particles. J. A. Crowther, H. Liebmann, and R. Jones (Phil. Mag., 1939, [vii], 28, 64—72; cf. A., 1938, I, 617).—The influence of X-rays on the rhythmical variations in the electrophoretic mobility u of colloidal Au particles of various known sizes has been studied. Both the max. change in u and the dose necessary to produce this change increase strikingly as the radius a of the particles falls. These results are in conformity with the suggestion that the magnitude of the charge gained or lost during irradiation is independent of the particle size. The dose D required to reduce u to a min. is $\propto (a + z)^{-2}$, where z is a const. $\approx 8 \times 10^{-7}$ cm., while that needed to cause a given change in u is of the type $D = Ae^{w/kT}$, where A and w are consts., k is Boltzmann's const., $w = 0·09$ e.v. for graphite and 0·11 for Au. T. H. G.

Magnitude and determination of potentials due to falling particles during centrifuging of colloidal solutions. K. Hoffmann (Kolloid-Z., 1939, 88, 17—21).—A device for measuring the potentials is described. In sols of As_2S_3 and TiO_2, centrifuged at 3000 r.p.m., potentials (V) of several mv. were developed. V is $\propto$ (sol concn.) $\times$ (sp. resistance)/η. F. L. U.

Deformation of the double layer by the motion of suspended particles. J. J. Hermans (Chem. Weekblad, 1939, 36, 502—508).—A review, particularly of the phenomenon of relaxation in colloidal systems. S. C.

Thermo-diffusion in liquids. K. Wirtz (Naturwiss., 1939, 27, 369).—Theoretical. The motion of

particles through liquids by thermo-diffusion is considered on the basis of kinetic and hydrodynamic theory. The former is best applied to particles of which the size and mass are comparable with those of the solvent (e.g., ions in H_2O, or a mixture of liquid isotopes or their compounds), whilst the latter is specially applicable to large particles. A. J. M.

Law of mass action. A. BOUTARIC (Ann. Soc. Sci. Bruxelles, 1939, [i], **59**, 257—266).—For homogeneous reactions of the type $A + C \rightleftharpoons AC$ and $2A + C \rightleftharpoons A_2C$ simple relations exist between the mol. vols. of the substances taking part and the equilibrium const. F. L. U.

Thermal dissociation of oxygen. E. H. RIESENFELD (Z. anorg. Chem., 1939, **242**, 47—48; cf. A., 1925, ii, 989).—The formation of O_3, in quantities $\gg$ calc. from the partial pressure of at. O, when pure O_2 is passed through heated quartz capillaries, cannot be purely thermal (cf. Wartenberg, A., 1938, I, 457), and accordingly the author's interpretation still holds. F. J. G.

Existence of hexamethylenetetramine salts in solution. A. RATTU (Annali Chim. Appl., 1939, **29**, 221—225).—Cryoscopic methods indicate that addition of aq. acids to aq. $(CH_2)_6N_4$ produces partial formation of additive compounds, but this is followed by hydrolysis to CH_2O and NH_4 salts. F. O. H.

Effect of alcohols on the partial pressure of acetone. J. E. W. RHODES (J.C.S., 1939, 1135—1137).—V.p. measurements have been made on mixtures of $COMe_2$ with n-heptyl, benzyl, and m-nitrobenzyl alcohols, using the method previously described (A., 1933, 350), the Bremer–Frowein tensimeter, the isoteniscope, and the Ramsay–Young methods. A considerable decrease in v.p. is observed in the presence of substances known to catalyse the Fischer–Giebe alcohol–aldehyde reaction although this reaction actually fails with ketones, the expected acetals being too readily hydrolysed. A similar, though smaller, lowering of the v.p. is observed even in presence of aq. HCl which would favour hydrolysis of the acetals. The observations confirm those of Errera and Seck (A., 1938, I, 342), who suggest that the alcohol–acetone complexes are due merely to dipole interaction; the v.p. evidence, however, suggests that they are acetals. T. H. G.

Electrical conductivity of solutions containing zinc hydroxide and sodium hydroxide. S. M. MEHTA and M. B. KABADI (J. Indian Chem. Soc., 1939, **16**, 223—228).—Addition of $Zn(OH)_2$ diminishes the equiv. conductance Λ of NaOH owing to formation of Na_2ZnO_2. Na_2ZnO_2 exists in conc. NaOH solution but undergoes hydrolysis on dilution and the $Zn(OH)_2$ is colloidal. Below a crit. concn. $Zn(OH)_2$ separates in cryst. or amorphous forms. This is substantiated by the increased vals. of Λ in dil. solutions. W. R. A.

Spectrophotometric study of the hydrolysis of ferric salts. J. CATHALA and J. CLUZEL (Compt. rend., 1939, **209**, 43—45).—From the experimental data recorded previously (cf. A., 1939, I, 85, 205) on the ageing of solutions of Fe^{III} salts of varied $[Fe^{\cdots}]$ and $[H^{\cdot}]$ it is inferred that: (i) for a fixed p_H, the course of the ageing is determined by the $[Fe^{\cdots}]$; (ii) for solutions more acid than a certain p_H (p_H*) the absorption is const. and independent of time; (iii) the val. of p_H* increases with decrease in $[Fe^{\cdots}]$; (iv) for media of $p_H > p_H*$ the absorption varies with time and finally attains a const. val., independent of the p_H, before any turbidity of the solution becomes noticeable; (v) for media of $p_H \sim p_H*$ a period of induction is observed, whilst at much higher p_H the progress is exponential; (vi) for p_H where the absorption is time-independent a linear relation exists between the concn. of absorbent and the total [Fe] in the solution. W. R. A.

Ester hydrolysis equilibria : formic acid esters. R. F. SCHULTZ (J. Amer. Chem. Soc., 1939, **61**, 1443—1447).—The hydrolysis equilibrium "consts." for Me, Et, and Pr^a formates increase as the proportion of H_2O used increases. In presence of HCl the "consts." also increase with the amount of HCl. The energies of formation of Me, Et, and Pr^a formate at $21°$ are $-69,000$, $-69,000$, and $-70,300$ g.-cal., respectively. R. S. C.

Thermodynamics of strong electrolytes in protium–deuterium oxide mixtures. II. Potassium chloride. V. K. LA MER and E. NOONAN (J. Amer. Chem. Soc., 1939, **61**, 1487—1491; cf. A., 1939, I, 199).—Measurements at $5°$, $25°$, and $45°$ have been made of the temp. coeff. of the cell Ag–AgCl|KCl (m in D_2O)|KCl (m in H_2O)|AgCl–Ag, to determine the various thermodynamic properties (mol. free energy, entropy, and heat content changes) of the transfer process KCl (in D_2O) = KCl (in H_2O). These properties are interpreted in terms of the difference of solvation energies of the ions in the two solvents. The abs. activity coeffs. of KCl in isotopic mixtures have been calc. (KCl in H_2O at infinite dilution = 1). W. R. A.

Thermodynamic constants of bromine chloride. Equilibrium reaction between nitric oxide, bromine, chlorine, nitrosyl bromide and chloride, and bromine chloride. C. M. BEESON and D. M. YOST (J. Amer. Chem. Soc., 1939, **61**, 1432—1436).—Using specially purified reagents, the gas equilibrium of BrCl with the various gases given in the title has been investigated in the range 372—$492°$ K. The procedure and necessary corrections are outlined. Vals. of $K = P_{Br_2} \cdot P_{Cl_2}/P_{BrCl}^2$ are given for various temp. By combining the mean val. of K with recorded data for K' (val. of K at room temp.) vals. of ΔH, the heat content change for the formation of 2 mols. of BrCl, are obtained. These differ widely according to the val. of K' chosen. However, spectroscopic data indicate that ΔH is -465 g.-cal. The most probable free energy equation for the reaction, $Br_2(g) + Cl_2(g) = 2BrCl$, is $\Delta G_T = -465 - 2.83T$. W. R. A.

Primary and secondary acids and bases. G. N. LEWIS and G. T. SEABORG (J. Amer. Chem. Soc., 1939, **61**, 1886—1894).—Defining an acid as any substance one atom of which is capable of receiving the basic electron pair of another atom into its valency, co-ordination, or resonance shell, it is necessary to subdivide acids and bases into two categories,

the primary class requiring no energy of activation in mutual neutralisation, and the secondary class requiring considerable energy of activation to bring about combination even between a secondary acid and a primary base and vice versa. The pseudo-acids of Hantzsch are examples of secondary acids, but many substances behave as secondary acids and cannot be classified as pseudo-acids. Neutralisation experiments at temp. down to $-160°$ are described, enabling a large no. of substances to be classified as primary or secondary, strong or weak acids or bases. No new examples of secondary behaviour have been found, but it is suggested that every secondary acid and base exists independently in a corresponding primary form and that the relative amounts of each and their energy differences could be ascertained by kinetic investigations. No satisfactory explanation of the difference in behaviour of the two classes has been found. The most probable hypothesis is that two electromeric forms can exist, incapable of reson-ance with each other, and differing in the laws which govern electron distribution.   W. R. A.

Trinitrotriphenylmethide ion as a secondary and primary base. G. N. Lewis and G. T. Sea-borg (J. Amer. Chem. Soc., 1939, **61**, 1894—1900; cf. preceding abstract).—Various substituted CPh$_3$ cations behave as secondary acids and, by analogy, CPh$_3$ anions should be secondary bases. In alkaline EtOH solution CH(C$_6$H$_4$·NO$_2$-p)$_3$ gives an intense blue colour due to the C(C$_6$H$_4$·NO$_2$)$_3$ anion (I). When this solution is acidified with AcOH at from $-30°$ to $-80°$ the colour fades slowly and the lower is the temp. the slower is the fading; therefore the blue ion is not behaving as a primary base with respect to addition of an acid at the central C atom. The kinetics of the neutralisation by 13 acids have been investigated; the rates of fading diminish with diminishing acid strength. Over a wide range of acid strength (CH$_2$Cl·CO$_2$H to EtOH) the heat of activation is nearly const., with a mean val. of 8·9 kg.-cal. This const. val. is interpreted as the difference in energy between the primary and secondary forms of the base. Since the actual composition of (I) depends on the solvent and on the presence of other solutes, small deviations from the const. val. are found. Although when acid is added to its central C (I) behaves as a secondary base, it behaves as a primary base when acid is added to the NO$_2$ groups. Thus an orange colour is instantly produced by (I) in presence of strong acids, and its rate of fading has been in-vestigated. Formulæ are proposed for the various products.   W. R. A.

Acidic strengths of the stereoisomeric diaquo-diamminoplatinous ions. K. A. Jensen (Z. anorg. Chem., 1939, **242**, 87—91).—In the work of Grünberg (A., 1936, 428) the equilibrium [Pt(NH$_3$)$_2$(OH)$_2$] + 2Cl′ $\rightleftharpoons$ [Pt(NH$_3$)$_2$Cl$_2$] + 2OH′ may possibly have affected the results. Accordingly the titration curves of solutions of cis- and trans-[Pt(NH$_3$)$_2$(NO$_3$)$_2$], which contain the ions cis- and trans-[Pt(NH$_3$)$_2$(H$_2$O)$_2$]′′, have been determined. The acidity consts. are $K_1 = 2·76 \times 10^{-6}$, $K_2 = 4·79 \times 10^{-8}$ for the cis-compound, and $K_1 = 4·79 \times 10^{-5}$,

$K_2 = 4·17 \times 10^{-8}$ for the trans-compound, in agree-ment with vals. calc. from the results of Grünberg.   F. J. G.

Electrostatic influence of substituents on the dissociation constants of organic acids. I, II. J. G. Kirkwood and F. H. Westheimer (J. Chem. Physics, 1939, **7**, 437).—Errata (A., 1938, I, 574) are noted.   W. R. A.

Dissociation constants of organic acids from solubility measurements. W. V. Bhagwat (J. Indian Chem. Soc., 1939, **16**, 235—238).—Data on CH$_2$Cl·CO$_2$H, CHCl$_2$·CO$_2$H, EtCO$_2$H, and NH$_2$·C$_6$H$_4$·CO$_2$H are recorded.   W. R. A.

Dissociation constants of isomeric halogeno- and nitro-anilines and -phenols. H. O. Jenkins (J.C.S., 1939, 1137—1140; cf. A., 1939, I, 321).—A linear relationship exists, with a few exceptions, between the dissociation consts. of these compounds and the electrostatic potential at the C to which the NH$_2$ or OH is attached. A proof is offered of the proportionality of the mesomeric effect to the induc-tive effect for each nuclear position in these systems. It is usually stated that the dissociation consts. of the o-substituted anilines are abnormally low, but they conform perfectly to the linear relationship and so must be regarded as normal. The substituted phenols also fail to show the ortho-effect.   T. H. G.

Dissociation constants of heterocyclic com-pounds of the formula $\overline{CR_2 \cdot CO \cdot NH \cdot CO \cdot X}$. H. Erlenmeyer and A. Kleiber (Helv. Chim. Acta, 1939, **22**, 851—852; cf. A., 1938, II, 462).—The negative logarithms of the dissociation consts. (p_K) for 2 : 4-diketothiazolidine, 4-keto-2-thionthiazolidine, and 2 : 4-diketo-oxazolidine are 6·77, 5·77, and 5·84, respectively, whilst the corresponding vals. for their 5 : 5-Me$_2$ derivatives are 6·64, 5·38, and 6·11. No abrupt changes in acidity are observed similar to that between barbituric acid and dimethylbarbituric acid (cf. J.C.S., 1906, **89**, 1831).   J. W. S.

Equilibria of mercuric oxide in solutions of dilute nitric acid. Evidence for stepwise dis-sociation of bases. A. B. Garrett and W. W. Howell (J. Amer. Chem. Soc., 1939, **61**, 1730—1734). —Dissociation consts. of Hg(OH)$_2$, evaluated from data obtained on the solubility of HgO in aq. HNO$_3$ (0·00005—0·16M.), agree with the fact that Hg(OH)$_2$ solutions have a very low conductivity and give p_H ~ 7. They agree also with the data obtained from e.m.f. measurements by Kolthoff. The data indicate that Hg(OH)$_2$ dissociates in a step-wise manner and that the H′ and OH′ ions contributed by Hg(OH)$_2$ in aq. solution are $<$ those contributed by the solvent.   W. R. A.

[System] trisodium phosphate–sodium fluor-ide.—See B., 1939, 822.

Binary system sulphanilamide–thymol. U. Gallo and V. Baldini (Boll. Chim. farm., 1939, **78**, 317—320).—The f.p. curve of sulphanilamide (I)–thymol mixtures indicates a eutectic at 2·3% of (I), 48·8°. Partial miscibility of liquid phases occurs with 72·2—41·7% of (I). The mixture with 44·5% of (I)

remains liquid for several days unless seeded with crystals of the eutectic mixture.　　F. O. H.

Equilibrium of sodium chloride–sodium chlorate–water systems. A. LINARI (Annali Chim. Appl., 1939, **29**, 189—195).—Data for the mutual solubilities of NaCl and $NaClO_3$ in aq. solution at the b.p. and at normal and reduced pressures are recorded and discussed.　　F. O. H.

Mixed crystals in the vitriol series. V. A. BENRATH and E. NEUMANN (Z. anorg. Chem., 1939, **242**, 70—78; cf. A., 1935, 292).—Equilibrium data at 0—100° for the system $NiSO_4$–$MgSO_4$–H_2O are given. Complete series of mixed crystals of the heptahydrates, monoclinic hexahydrates, and monohydrates, and a small range of tetragonal hexahydrate mixed crystals, are found.　　F. J. G.

Vanadium oxides. E. HOSCHEK and W. KLEMM (Z. anorg. Chem., 1939, **242**, 63—69).—The phase relationships in the system V–O have been studied by means of X-rays and magnetic measurements. Preps. from VO_2 to $VO_{1·83}$ belong to the α phase, $VO_{1·75}$ to another phase, β, whilst $VO_{1·60}$ shows the lines of β and of V_2O_3 (γ). These relationships resemble those found in the system Ti–O, but the relationships in the region VO_2 to V_2O_5 are not clear. $VO_{2·05}$ shows the lines of VO_2 and also those of another phase, designated α', whilst $VO_{2·33}$ shows the lines of α' and of V_2O_5. The preps. are all paramagnetic; ferromagnetism does not occur. The results of the magnetic measurements are not always in agreement with the findings of Perakis (A., 1927, 288, 717, 805). V_2O_3 shows a sharp increase of χ with rising temp. at −100°, whilst in the α and α' regions this occurs at 65—70°, and without change of lattice structure. The course of the χ–composition isotherms does not clarify the phase relationships in the α–α'–V_2O_5 region, but indicates that if there is any two-phase region between α and β it must be very small.　　F. J. G.

Ternary system : ethyl alcohol, toluene, and water at 25°. E. R. WASHBURN, A. E. BEGUIN, and O. C. BECKORD (J. Amer. Chem. Soc., 1939, **61**, 1694—1695; cf. A., 1937, I, 617).—The solubility curve for the ternary system EtOH–PhMe–H_2O has been determined at 25°. The n of the saturated solutions, and the compositions of various conjugate solutions throughout a large concn. range are recorded.　　W. R. A.

Application of physico-chemical analysis to study of the equilibrium of liquid phases in three-component systems. I. Equilibrium of liquid phases in the system acetic acid–aniline–light petroleum. E. F. SHURAVLEV (J. Phys. Chem. Russ., 1938, **12**, 639—646).—The phase of composition $2NH_2Ph,AcOH$ is less sol. in, and dissolves more, light petroleum than do any of the phases of near compositions. At the upper crit. point of miscibility the ratio $NH_2Ph : AcOH$ is 3 : 7 by wt. The compound $NH_2Ph,2AcOH$ cannot be detected by solubility measurements.　　J. J. B.

Introduction to the phase rule. I. H. G. DEMING (J. Chem. Educ., 1939, **16**, 215—218).　　L. S. T.

Heat of formation and specific heat of tantalum nitride. S. SATOH (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 437—444).—The sp. heat of TaN has been measured by the ice calorimeter over the temp. ranges 0—99·5°, 0—305·3°, and 0—500·3° and is given by $c = 0.04785 + 7.068 \times 10^{-5}\theta - 5.808 \times 10^{-8}\theta^2$. From these data the heat of formation of TaN at 25° is 58,650 g.-cal.　　W. R. A.

Heat of oxygenation of hæmoglobin. See A., 1939, III, 551.

Heats of combustion of mono- and di-saccharides. T. H. CLARKE and G. STEGEMAN (J. Amer. Chem. Soc., 1939, **61**, 1726—1730).—Heats of combustion of six sugars have been measured in a bomb calorimeter standardised with BzOH. The vals., reduced to the standard state $-\Delta U_R$, are : *l*-sorbose, −670·30; β-*d*-fructose, −671·70; α-*d*-galactose, −666·76; β-lactose, −1345·47; β-maltose monohydrate, −1360·50; α-lactose monohydrate, −1354·66 kg.-cal. per mol. for the const.-pressure process at 25°.　　W. R. A.

Heat of reaction of thiosulphate with tri-iodide. H. W. ZIMMERMANN and W. M. LATIMER (J. Amer. Chem. Soc., 1939, **61**, 1554—1555).—The heat of dissolution of $Na_2S_2O_3,5H_2O$ at 25° is 11,300±35, heat of dilution 11,170±100 g.-cal. Vals of $\Delta H_{298·1}^0$ for the following reactions are : $2Na_2S_2O_3,5H_2O$ (*s*) + $I_3' = S_4O_6'' + 4Na^{\cdot} + 3I' + 10H_2O$, 13,760±200; $2S_2O_3'' + I_3' = S_4O_6'' + 3I'$, −8580±250; I_2 (*s*) + $I' = I_3'$, 820; $2S_2O_3'' + I_2$ (*s*) $= S_4O_6'' + 2I'$ (I), −7760±250 g.-cal. For (I) $\Delta S_{298·1}^0 = 42$, $\Delta G_{298·1}^0 = -20,200$ and the potential $E° = 0.44$. $E°$ for $2S_2O_3'' = S_4O_6'' + 2e^-$ is −0·10.　　W. R. A.

Heats of organic reactions. VIII. Further hydrogenations, including those of some acetylenes. J. B. CONN, G. B. KISTIAKOWSKY, and E. A. SMITH (J. Amer. Chem. Soc., 1939, **61**, 1868—1876; cf. A., 1939, I, 28).—The following heats of hydrogenation have been determined (referred to 355° K. in the gaseous phase) : (cyclic hydrocarbons) *cyclo*heptene → *cyclo*heptane (I) −26,515±20, *cyclo*heptadiene → (I) −51,260±49, *cyclo*heptatriene → (I) −72,846 ±10, *cyclo*octene → *cyclo*octane −23,525±35; (cyclic ketones) *cyclo*pentanone → *cyclo*pentanol −12,498±61, *cyclo*hexanone → *cyclo*hexanol −15,424 ±81; (acetylenes) $C_2H_2 \rightarrow C_2H_6$ −75,062±66, CH:CMe → C_3H_8 −69,703±14, CMe:CMe → C_4H_{10} −65,581±130 kg.-cal. per mol. Consideration of the new and recorded data on the heats of addition reactions indicates the magnitude of steric hindrances caused by non-bonded atoms in simple org. mols.　　W. R. A.

Reference points and signs in chemical thermodynamics. E. LANGE (Kolloid-Z., 1939, **88**, 89—96).—Existing conventions are discussed and a simplified system is recommended.　　F. L. U.

Entropy of electrolyte solutions. Z. SZABÓ (Magyar Chem. Fol., 1936, **42**, 49—54; Chem. Zentr., 1937, i, 1646—1647).—The entropy of an electrolyte solution of concn. Σm_i is given by $S = \Sigma m_i(C_{pi} \log T - R \log a_i + k_i)$, in which C_{pi} is the partial mol. heat and a_i the activity, taken as unity for the pure substance. The const. k_i depends on the

units and the nature of the substance. The calc. S changes on dilution of HCl solutions are in accord with experimental data. A. J. E. W.

Approximate formulæ for calculation of the free-energy changes and conditions of equilibrium of reactions from thermo-chemical data. H. ULICH (Z. Elektrochem., 1939, 45, 521—533).—Theoretical. J. W. S.

Thermodynamics of hyponitrous acid. W. M. LATIMER and H. W. ZIMMERMANN (J. Amer. Chem. Soc., 1939, 61, 1550—1554).—The heat of oxidation of $H_2N_2O_2$ by Br and its heat of neutralisation have been measured in 0·001M. solution at 25°. The ionisation consts. at 25° are K_1 9±2 × 10^{-8}, K_2 1·00± 0·25 × 10^{-11}. Using these data with estimated entropies of the acid and its ions, provisional vals. of the free energies are calc. to be: $\Delta G^0_{298·15}$ $H_2N_2O_2$ 11,000±2000, HN_2O_2' 20,400±2000, N_2O_2'' 35,400± 2000 g.-cal. Observations on the stability of aq. $H_2N_2O_2$ and on the rate of reaction with Br are recorded. W. R. A.

Equilibrium theory of ionic conductance. M. H. GORIN (J. Chem. Physics, 1939, 7, 405—414).—A theory for ionic conductivity is proposed in which the equilibrium between the central ion and its ionic atm. is assumed to be not appreciably distorted by the application of an external field. Ionic radii are thus obtained by extrapolation of conductivity and transference data to infinite dilution. Using these vals. of the radii in the theoretically derived equations, expressions for the conductivity and transference are obtained which agree with experimental data up to 0·02M., and discrepancies at 1·00M. are not large. The correlation of the theoretical ionic radii with the corresponding vals. of Λ_0 is discussed. W. R. A.

Extrapolation of conductivities of strong electrolytes of various valency types. B. B. OWEN (J. Amer. Chem. Soc., 1939, 61, 1393—1396).—The equation of Onsager and Fuoss (cf. A., 1933, 28) agrees with the conductivity data for 1-1-, 2-1-, 3-1-, 4-1-, and 2-2-valent strong electrolytes for a limited concn. range. This equation therefore allows the extrapolation of the data for multivalent strong electrolytes for which accurate activity coeff. data are not available, and a simple graphical method is described. W. R. A.

Electrolytic condition of aniline hydrochloride, aniline hydriodide, and α-naphthylamine hydriodide in aniline solution. H. H. HODGSON and E. MARSDEN (J. Amer. Chem. Soc., 1939, 61, 1592—1594).—The mol. conductivities of NH_2Ph,HCl, NH_2Ph,HI, and α-$C_{10}H_7\cdot NH_2,HI$ have been measured at 15° and plotted against the concn. in NH_2Ph solution. The three graphs are similar and support the assumption of solvate formation, in agreement with the data on phenylation by means of acids or by I (cf. A., 1938, II, 404). W. R. A.

Calculation of the absolute potential of the calomel electrode from the free energy of hydration of gaseous ions. A. FRUMKIN (J. Chem. Physics, 1939, 7, 552—553).—Polemical against Latimer et al. (cf. A., 1939, I, 202). W. R. A.

Electrochemical behaviour of mercury in solutions containing foreign ions. P. SZARVAS (Magyar Chem. Fol., 1936, 42, 66—81; Chem. Zentr., 1937, i, 1645—1646).—The potential (E) of Hg in O_2-free solutions depends chiefly on the nature and concn. of the anions, and is $\sim \propto$ log (ion activity). Heavy metal cations raise E, but light metals are without measurable effect. The E max. in the electrocapillary curve is reached with a slowly dropping (" overflowing ") electrode in O_2-free solutions, showing that the difference of potential between the dropping and static Hg electrodes is not a [Hg·˙] effect, but is due to self-polarisation of the dropping electrode by anion adsorption. A. J. E. W.

Photovoltaic cells. Spectral sensitivites of copper, silver, and gold electrodes in solutions of electrolytes. P. E. CLARK and A. B. GARRETT (J. Amer. Chem. Soc., 1939, 61, 1805—1810).—The spectral sensitivities of Cu, Ag, and Au electrodes have been determined for monochromatic radiation of from 3650 to 6908 A. The anomalous sensitivity of metals coated with oxide, halide, etc. is attributed to the coatings. A similarity in the mechanism of the photovoltaic and photo-electric effects is suggested from a comparison of the photovoltaic and photo-electric threshold vals. of metals at various stages of out-gassing. W. R. A.

Theory of diffusion potential. Stationary diffusion and Henderson distribution. L. G. SILLÉN (Physikal. Z., 1939, 40, 466—473).—The general equations governing the state of stationary diffusion between two different solutions of electrolytes are deduced. The Planck differential equations are retained in a more modern form. The conditions under which stationary diffusion with a Henderson distribution will occur are considered. A. J. M.

Effect of aluminium hydroxide on the overvoltage of hydrogen. F. A. MANUSOVA (J. Phys. Chem. Russ., 1938, 12, 647—652).—In the equation of Tafel $\eta = a - b \log l$ for the overvoltage at a Pt electrode, b has the val. 0·10—0·13 in H_2SO_4 at p_H 1·6 but 0·25—0·30 in $Al_2(SO_4)_3$ at p_H 1·7. Similarly it is 0·16—0·17 in NaOH at p_H 11·2 and 0·25—0·30 in $NaAlO_2$ at the same p_H. Colloidal $Al(OH)_3$ seems to alter the double layer on the cathode. J. J. B.

Electrical properties of organometallic [compounds]. P. BRUN (J. Chim. phys., 1939, 36, 147—159; cf. A., 1938, I, 624).—The formation of organometallic compounds has been studied by measuring the intensity (i) of the current and the p.d. between two electrodes (one of Pt) in a cell containing the reaction mixture. i decreases with the activity of the reaction in the order Mg, Ca, Al. The difference is greatest between Mg and Ca. This order of progression is contrary to that of the usual chemical properties Ca, Mg, Al, but the same as that of the ionisation potentials of the metals. W. R. A.

Polarographic studies with the dropping mercury cathode. LXXVIII. Electrodeposition of manganese from cyanide solutions. E. T. VERDIER. LXXIX. Simultaneous occurrence of the two known protein effects

produced in buffered cobalt solutions. E. JURKA (Coll. Czech Chem. Comm., 1939, 11, 216—232, 243—255).—LXXVIII. The deposition of Mn from solutions containing excess of Cl', ClO$_4$', CNS', CN', and various buffers has been studied. Contrary to expectation, Mn is easily and reversibly deposited from the complex Mn(CN)$_6$'''' in presence of 1·5N-KCN. With 0·5—1·0N-KCN, hydrolysis is sufficient to produce Mn(OH)CN, and some Mn is deposited reversibly at the first wave and the remainder irreversibly at the second. With 0·1N-KCN no deposition occurs at the first or second waves, but deposition at a third wave due to Mn(OH)$_2$ occurs. The data obtained in buffers support this explanation.

LXXIX. From an examination of the influence of serum and Co salt concns. on the " prenatrium wave " and " double wave " which are shown in current–voltage curves obtained with buffered Co solutions of human blood serum, it is concluded that both waves are due to H$_2$ evolution catalysed by protein SH groups, catalysis in the latter case being activated by Co according to Brdička's theory (A., 1933, 619, 681).
C. R. H.

Polarographic study of reduction of metanil-yellow at a dropping mercury electrode. (MLLE.) H. T. NGA (J. Chim. phys., 1939, 36, 164—166).— Reduction occurs at all vals. of p_H from 1·92 to 12·32, and its speed decreases as the p_H increases. 2 atoms of H are used for each mol. of the dye.   F. L. U.

Influence of concentration on the reduction potential of sulphonated monoazo-dyes at the dropping mercury electrode. (MLLE.) H. T. NGA (Compt. rend., 1939, 208, 1979—1981).—The reduction potential of orange-2 and five similar dyes in 10^{-5}—10^{-3}N. solution at different p_H (3—11) falls normally as the concn. increases up to an optimum val. (0·4—2 × 10^{-4}N.), and then rises steadily. The reduction processes are thus complex, and their nature is closely related to the dye concn.
A. J. E. W.

Ignition of inflammable gases by hot moving particles. S. PATERSON (Phil. Mag., 1939, [vii], 28, 1—23).—Whether or not an inflammable gas is ignited by hot surfaces depends on the concn. of the gas, the temp., speed of the particles, etc. An apparatus for examining the effect of speed when the surface is that of a small sphere is described in detail. The results indicate that, with mixtures of coal gas and air and Pt spheres, there is a min. ignition temp. for a given sphere size. This temp. is independent of the richness of the mixture and the age of the sphere and is well above the ignition temp. found with more usual sources of ignition. When the temp. exceeds the min., ignition always occurs unless the speed of the particles is > a crit. val. which varies linearly with temp. The slope of this line decreases as the concn. of coal gas increases from the lower explosive limit until a min. val. is reached, and afterwards increases to the upper explosive limit. Quartz spheres give exactly the same results except that the temp.–crit. speed characteristics are steeper. A simple theory which explains part of the results is given. The problem is of great importance in connexion with accidents in coal mines.   T. H. G.

Kinetics of OH radicals as determined by their absorption spectrum. V. Spectroscopic determination of a rate constant. O. OLDENBERG and F. F. RIEKE (J. Chem. Physics, 1939, 7, 485—492).— The efficiency of recombination of free OH radicals by triple collisions is > 1 if the no. of such collisions is calc. from gas kinetic data. The velocity coeff. of the reaction has been determined in abs. units by measuring the intensities of OH absorption lines on Fabry–Pérot plates in the " standard discharge " and combining with f vals. (A., 1938, I, 493). It is concluded that OH radicals form collision complexes which have a lifetime ≫ the duration of bimol. collisions between stable mols.   W. R. A.

Combustion of aromatic and alicyclic hydrocarbons. II. Ignition of aromatic hydrocarbons at high temperatures. J. H. BURGOYNE (Proc. Roy. Soc., 1939, A, 171, 421—433; cf. A., 1937, I, 522).—The hydrocarbons investigated were C$_6$H$_6$, PhMe, PhEt, PhPr^a, o-, m-, and p-xylene, and mesitylene. The ignition reactions were studied between 450° and 750°. The applicability of the pressure–temp. relation $\log(p/T) = A/T + B$ is examined; in three cases A increased with temp. Dilution with N$_2$ decreases the crit. ignition pressure whilst He has the reverse effect. Branching chain mechanisms play an important part in the ignition of C$_6$H$_6$ and its higher monoalkyl derivatives, but with the methylbenzenes the reaction is of a more thermal character.   G. D. P.

Spontaneous inflammation of n-hexane–air mixtures. E. FRÉLING and P. LAFFITTE (Compt. rend., 1939, 208, 1905—1907).—The ignition regions of mixtures containing 7, 6, 4·6, 3, 2, and 1·5% of C$_6$H$_{14}$, for ignition pressures (p) <1 atm., have been studied; typical p–θ curves are given. A region of cold flames with induction periods (τ) of 1—40 sec. occurs at 270—440°, with a min. p val. (80—200 mm. with 7—1·5% of C$_6$H$_{14}$) at 360°. A weak luminescence occurs below this region, particularly at 400—450°. Above 440° a region of more violent ignition, giving a typical lower-limit curve, is observed; τ (1—10 sec.) and the luminosity of ignition are max. at ~540°. With mixtures containing < the stoicheiometric [C$_6$H$_{14}$] (2·16%) an additional broad ignition peninsula is observed below the normal lower limit (p <200 mm.; θ >620°). This region is characterised by quiet inflammation and long τ vals. (≻70 min. with 1·5% of C$_6$H$_{14}$); the region is enlarged and τ is increased by reducing the [C$_6$H$_{14}$].   A. J. E. W.

Combustion of hydrocarbon mixtures. Mixtures of decahydronaphthalene and dicyclopentadiene. P. DUMANOIS, G. REUTENAUER, and M. PRETTRE (Compt. rend., 1939, 208, 1814—1816).— Dicyclopentadiene (I) does not inflame in O$_2$ at <300°, but both (I) and decalin (II) undergo slow oxidation, at 110—200° and 250—280°, respectively. (II) and (I)–(II) mixtures [≻75% (I)] inflame at <300°; a certain min. concn. of (II) is required with a given O$_2$ pressure, whatever the composition of the (I)–(II) mixture. The max. mixture concn. giving inflammation at <300° is approx. const. with <25% of (I), and decreases with higher concn. of (I). The lower limiting [O$_2$] rapidly increases on substituting (I) for

(II); tetralin (cf. A., 1939, I, 204) has no such effect. It is inferred that chains are initiated by (II), and propagated by both (I) and (II), but participation of (I) in the chain reduces the rate of oxidation and inhibits inflammation. Tetralin has no similar action. A. J. E. W.

Properties of explosive gas mixtures. I. **Hydrogen–air and ethylene–air systems.** W. S. YOUNG and N. W. KRASE (Trans. Amer. Inst. Chem. Eng., 1939, **35**, 337—358).—Data for the explosive limits, the ratio of max. to initial pressures, the burning velocities, etc. for H_2–air and C_2H_4–air mixtures were confirmed, using a quartz crystal and cathode-ray oscillograph arrangement for measuring the pressure rise in a small spherical explosion chamber. F. J. B.

Thermal chlorination of chloroform. H. A. TAYLOR and W. E. HANSON (J. Chem. Physics, 1939, **7**, 418—425).—The thermal chlorination of $CHCl_3$ has been determined between 260° and 320°, for $CHCl_3 : Cl_2$ ratios from 10 to $\frac{1}{8}$, by a dynamic method which is described. At high $[CHCl_3]$ the reaction is independent of $[CHCl_3]$ and unimol. with respect to Cl_2; at lower $[CHCl_3]$ the reaction depends to a small degree on the $[CHCl_3]$ in addition to the first-order dependence on Cl_2. The following mechanism indicates the general course of the thermal reaction : $Cl_2 \rightarrow 2Cl$, $Cl + CHCl_3 \rightleftharpoons CCl_3 + HCl$, $CCl_3 + Cl_2 \rightleftharpoons CCl_4 + Cl$, and $2CCl_3 + Cl_2 \rightarrow 2CCl_4$. The Cl atoms originate on the walls, and the chains are broken principally in the gas phase. W. R. A.

Thermal decomposition of azomethane. H. A. TAYLOR and F. P. JAHN (J. Chem. Physics, 1939, **7**, 470—473).—The thermal decomp. of azomethane, studied analytically from 292° to 336°, is unimol. with an activation energy of 52,500 g.-cal. per mol. The principal hydrocarbon product is CH_4. For 50 to 90% reaction the end-point (ratio of mols. produced to mols. of azomethane reacted) is const. at 1·95. The formation of $(NMe_2)_2$ as an intermediate, $(NMe:)_2 \rightarrow N_2 + 2Me$; $(NMe:)_2 + 2Me \rightarrow (NMe_2)_2$, is postulated. W. R. A.

Thermal decomposition of azomethane in presence of nitric oxide. F. P. JAHN and H. A. TAYLOR (J. Chem. Physics, 1939, **7**, 474—478 ; cf. preceding abstract).—In presence of large amounts of NO, azomethane (I) decomposes from 295° to 342° with only a small pressure increase. Traces of hydrocarbons are present in the volatile products. This indicates the initial dissociation of (I) into N_2 and Me radicals which combine with NO forming MeNO. That this is oxidised further by NO, giving N_2, H_2O, and CO_2, explains the presence of CO_2 in the reaction products. The ratio of NO to the amount of (I) disappearing is 2 for the upper limit. The energy of activation of the decomp. of (I) alone and in presence of NO is const. W. R. A.

Polymerisation process in a medium with continuously varying discontinuities. J. LÖBERING (Naturwiss., 1939, **27**, 457—463).—A review dealing with the various types of polymerisation and the kinetics of the polymerisation process. The effect of change of the physical properties of the reaction medium is considered with particular reference to the formation and decomp. of the polyoxymethylenes. A. J. M.

Rate of decomposition of hydrogen peroxide in nickel sulphate plating baths.—See B., 1939, 845.

Continuity of the kinetics of [reactions in] bleaching liquors. A. SKRABAL (Monatsh., 1939, **72**, 223—243).—The formation of halogenates in hypohalogenite solutions is governed by a general kinetic expression involving two reciprocal velocity coeffs. Λ_1 and Λ_2, viz., $-d\phi/dt = \tau^3\sigma^3[H^{\cdot}]^3[X']\phi^3 / \psi^2\{\psi\Lambda_1[H^{\cdot}][X'] + \tau\sigma\Lambda_2\phi\}$ (X = Cl, Br, I). τ and σ are the equilibrium consts. of the reactions $X_2 + X' \rightleftharpoons X_3'$ and $X_2 + H_2O \rightleftharpoons HOX + X' + H^{\cdot}$, respectively. $\phi = [X_3'] + [X_2] + [HOX] + [OX']$, representing the effective bleaching concn. of X, and $\psi = [H^{\cdot}]^2[X']^2 + \tau[H^{\cdot}]^2[X'] + \tau\sigma[H^{\cdot}] + \tau\sigma\delta$ (δ = dissociation const. of HOX). When the conditions are such that the net reaction may be expressed by a single simple equation, it is necessary to retain only one term of each of the above sums, corresponding with the form in which X predominates in the hypohalogenite solution ; the remaining terms are negligible or const. A no. of " degenerate " forms of the above expressions are derived by neglecting Λ_1 or Λ_2; these are infrequently obeyed experimentally, but permit a correlation of the velocity and equilibrium consts. The application of the above law is discussed in detail, and tested in typical cases ; tentative vals. of Λ_1 and Λ_2 are also given. The mechanism of the reactions is also discussed. A. J. E. W.

Solvent effects in addition reactions. I. **Addition of hydrogen bromide and chloride to *cyclo*hexene and Δ^γ-hexene.** S. F. O'CONNOR, L. H. BALDINGER, R. R. VOGT, and G. F. HENNION (J. Amer. Chem. Soc., 1939, **61**, 1454—1456).—Addition of HCl and HBr to *cyclo*hexene and Δ^γ-hexene is much faster in xylene, C_6H_6, $PhNO_2$, $CHCl_3$, or heptane than in Et_2O or dioxan. This is due to attraction of the " negative " addendum (Cl or Br) to the donor O. Dielectric consts. bear no relation to the reaction rates. R. S. C.

Reaction kinetics of filiform molecules in solution. I. **Alkaline saponification of polyvinyl acetates.** S. LEE and I. SAKURADA (Z. physikal. Chem., 1939, **184**, 268—272).—The saponification of mono- and of two poly-vinyl acetates (degrees of polymerisation 280 and 920) is bimol., the velocity coeffs., heats of activation, no. of collisions, and probability factors for each compound being the same and equal to the corresponding vals. for EtOAc. C. R. H.

Mechanism of solvolytic reactions of organic halides and the use of activity coefficients in the equation for a reaction velocity. P. D. BARTLETT (J. Amer. Chem. Soc., 1939, **61**, 1630—1635).—Polemical against Olson and Halford (A., 1938, I, 86) and Bateman *et al.* (A., 1939, I, 86). W. R. A.

Reactions between thiophen and calcium hypochlorite solutions. E. G. R. ARDAGH, W. H. BOWMAN, and A. S. WEATHERBURN (J.S.C.I., 1939, **58**, 249—251).—The two principal reactions between

hypochlorite solution and thiophen are : (1) the formation of chlorothiophens; (2) fission of the ring with oxidation of the S to SO_4''. At p_H 4·1 at room temp., and with a molar ratio of 5 OCl' : 1 C_4H_4S, 23—24% of the S is oxidised to SO_4'' in 30 min., whilst 76—77% of the thiophen is chlorinated. With increasing initial p_H vals. up to p_H 8·0 the proportion of thiophen oxidised increases. At p_H 8, 41% of the S was oxidised. With OCl' : C_4H_4S ratios >5 : 1, the % of the total S oxidised increases to an upper limit of ∼90% at 80 : 1 ratio and at p_H 8·0. With increase in the time of contact the proportion of the S oxidised increases somewhat.

Hydrolysis of guanidine by boiling potassium hydroxide solution.—See A., 1939, II, 410.

Velocity of crystallisation of sucrose. J. Dubourg and R. Saunier (Bull. Soc. chim., 1939, [v], 6, 1196—1208).—A method for measuring the rate of growth of a single crystal in a supersaturated solution is described. The crystal is placed in a wide tube containing the solution into which dips a plunger tube, closed at its lower end with a disc of optically plane glass, sufficiently wide to permit the entry of a microscope objective. The outer tube dips into a thermostat. Two dimensions of the crystal can be measured periodically without disturbance of the solution. The increase in the linear dimensions of a sucrose crystal $\propto$ time and is independent of the state of development of the crystal. The velocity of crystallisation (v) under any specified conditions can be defined as the wt. of sucrose deposited in unit time on unit crystal surface. The effects on v of variations of temp., concn., and p_H of the solution, and of the presence of glucose, caramel, NaCl, $CaCl_2$, and $Ca(NO_3)_2$ have been investigated. Agitation promotes the crystallisation of sucrose solutions owing to the production of nuclei. J. W. S.

Rate of growth of iodine crystals in foreign gases. M. Pahl (Z. physikal. Chem., 1939, 184, 245—267).—The foreign gases used were air, CO_2, and H_2, and the pressure was varied within the range 38—740 mm. Hg. The rate of I crystal growth, v, increases with reduction in pressure, extrapolation to zero pressure giving the same val. for each gas examined, viz., $0·82 \times 10^{-3}$ cm. per sec. for the linear rate of growth of the crystal surface. The calc. accommodation coeff. is 0·016 at 15° and an I pressure 5 mm. Hg. The influences of diffusion and of mol. layers of adsorbed foreign gas on v are discussed. C. R. H.

Kinetics of absorption of oxides of nitrogen by alkaline solutions. V. I. Atroschtschenko (J. Appl. Chem. Russ., 1939, 12, 167—181).—The velocity of absorption of N oxides by aq. alkalis (NaOH or Na_2CO_3) is max. for mixtures in which $[NO] = [NO_2]$, and rises with increasing concn. of oxides and of alkali, with increasing velocity of flow of the gas, and with increase in the effective surface of absorption. R. T.

Oxidation of sulphides by oxygen-enriched air. III. Oxidation of zinc sulphide. N. P. Diev and J. V. Karjakin (J. Appl. Chem. Russ., 1939, 12, 188—195).—The reaction of oxidation of

ZnS by atm. O_2 consists almost exclusively in $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$. At 500° the velocity of the reaction is independent of the $[O_2]$ of the air, and is very small. At temp. >700° the velocity rises rapidly with increasing $[O_2]$, 97% conversion being achieved after 15 min. at 900°, with 60% O_2.
R. T.

Rate of formation of ammonium benzoate. (Mme.) D. Markowska and G. Valensi (Compt. rend., 1939, 208, 1648—1650).—The formation of NH_4OBz from gaseous NH_3 and needle crystals of BzOH follows the relation $kt/d_0{}^2 = (4·167 + m) \log (1 + 0·24m) + (1 - m) \log (1 - m) (d_0$ = mean diameter of needles; m = fraction of total BzOH consumed) (cf. A., 1935, 1466). The rate of neutralisation is max. at 30°. The const. k is $\propto (NH_3 \text{ pressure})^{0·6}$.
A. J. E. W.

Rate of formation of α-naphthylamine hydrochloride. (Mme.) D. Markowska (Compt. rend., 1939, 208, 1727—1729).—The reaction between gaseous HCl and powdered α-$C_{10}H_7$·NH_2 (I) at const. temp. (0—45°) follows the equation $kt/e_0{}^2 = 6·2056 - (1 - m)^{\frac{1}{3}} - 5·2056(1 + 0·1921m)^{\frac{1}{3}}$, where m = fraction of (I) transformed into hydrochloride, and e_0 = mean diameter of particles. The rate is min. at 25°. The reaction is of the second order with respect to HCl. A. J. E. W.

Speed of nitrification of calcium carbide.—See B., 1939, 823.

Nature of catalysts. C. N. Hinshelwood (J.C.S., 1939, 1203—1212).—A lecture.

Reaction between hydrogen and oxygen sensitised by nitrogen peroxide. R. G. W. Norrish and F. S. Dainton (Nature, 1939, 144, 30—31).—Addition of foreign gas to an explodable mixture of H_2, O_2, and NO_2 of const. composition progressively lengthens the induction period and eventually converts the ignition into a slow reaction. The relative amounts required to quench ignition are A : N_2 : He : $CO_2 = 6 : 3·6 : 3 : 1$; the effectiveness in lengthening the induction periods is in the reverse order. At a given temp., increase in the pressure of the reactants causes the upper limit for ignition to rise to a max. and then to fall, and the lower limit to fall, less markedly, to a min. and then to rise. Explanations of these results are discussed. L. S. T.

Kinetics of the non-explosive and explosive reaction between hydrogen and oxygen sensitised by nitrogen peroxide. II. G. von Elbe and B. Lewis (J. Amer. Chem. Soc., 1939, 61, 1350—1355).—In the explosive reaction between H_2 and O_2 in presence of NO_2, no sp. reaction mechanism so far proposed which is based on the thermal theory describes the effect of pressure and mixture composition on the upper crit. $[NO_2]$. The mechanism derived previously on the basis of the isothermal branched-chain theory (cf. A., 1937, I, 621) has been extended to describe the observations of Foord and Norrish (cf. A., 1936, 34) on the induction periods in the explosive and non-explosive reactions. This theory fits experimental facts most satisfactorily. W. R. A.

Influence of nitrogen peroxide on the two-stage ignition of hydrocarbons. G. P. Kane

(Proc. Roy. Soc., 1939, A, **171**, 251—269).—Experiments were carried out on C_3H_8, n-C_4H_{10}, and MeCHO mixed with O_2 at pressures $<$ 1 atm. to determine the min. ignition pressure and time lag at different temp. Observations were also made on C_3H_8-air mixtures at higher pressures to confirm the influence of NO_2 on "knock" in internal-combustion engines. The results are in agreement with the view that NO_2 promotes a direct oxidation $A \rightarrow C$ at high temp. but inhibits the two-stage reaction $A \rightarrow B \rightarrow C$, predominant at low temp., by neutralisation of the active intermediate product B. G. D. P.

Mutarotation of xylose. (Mlle.) M. Murgier and E. Darmois (Compt. rend., 1939, **209**, 42—43).—In pure H_2O and in different buffer solutions the mutarotation of xylose, at 20° for the green Hg line, follows a logarithmic law, log ($\alpha_t - \alpha_\infty$) being a linear function of the temp. The speed of the reaction (K) for the buffer solutions K H phthalate–phthalic acid varies with the p_H, and the curve K–p_H resembles that for glucose. The curvature of this curve diminishes as anion concn. decreases, and at the same time the val. of the min. of K tends to that in H_2O, i.e., 0·22. Thus the negative ions of weak acids catalyse the mutarotation. For the acetic, phthalic, and phosphoric buffer mixtures K varies with the anion at const. p_H. The catalytic effect of the anions on the mutarotation is in the order $H_2PO_4' >$ phthalate ion $>$ OAc'. At const. p_H the catalytic effect of strong acids on the mutarotation is $HClO_4 \gg PhSO_3H \gg HCl$. W. R. A.

Acid catalysis in non-aqueous solvents. VII. Rearrangement of N-bromobenzanilide in chlorobenzene. R. P. Bell and O. M. Lidwell (J.C.S., 1939, 1096—1099).—Data obtained at 25° for the rearrangement of NBrBzPh (I) when catalysed by 8 org. acids are recorded. The catalytic consts. at infinite dilution, k_A, are related to the dissociation consts. of the catalysing acids, K_A, by $k_A = 0·0078 K_A^{0·61}$. The general behaviour is similar to that of NBrAcPh (II) with the exception that (II) is transformed more slowly than (I) with the stronger acids, although with the weaker acids the reverse is the case. C. R. H.

Homogeneous and α-Ag_2S-catalysed hydrogen sulphide reaction. H. Reinhold, W. Appel, and P. Frisch (Z. physikal. Chem., 1939, **184**, 273—301).—Between 350° and 550° the velocity coeff., k, of the homogeneous combination of H_2 and S at a glass surface is given by the empirical relation $k = ([H_2S]\sqrt{V^3}/[H_2]\sqrt{[S]})\{1 + ([H_2S]/[S])\}$, where V is the streaming velocity. The data support the views of Bodenstein and of Porret, who proposed the scheme $S_8 \rightarrow 4S_2$; $S_2 \rightarrow 2S$; $H_2 + S \rightarrow H_2S$. When catalysed by α-Ag_2S the velocity coeff. is given by $k_1 = ([H_2S]\sqrt{[S]}\sqrt{V})/[H_2]v$, where v is the vol. of the reaction vessel. k_1 is also $\propto$ the area of the catalyst surface. Conductivity measurements on the catalyst show that it contains principally adsorbed S and little adsorbed H_2. H_2 mols. which strike the catalyst surface are adsorbed and combine immediately with the adsorbed S. k_1 is small in comparison with the velocity of adsorption of S by the catalyst. C. R. H.

Catalytic interaction of acetone and *iso*propyl alcohol with deuterium on platinum. A. Farkas and L. Farkas (J. Amer. Chem. Soc., 1939, **61**, 1336—1341).—$COMe_2$ is reduced readily to C_3H_8 by D_2 in presence of platinised Pt foil at $\sim$150 mm. pressure and from $-42°$ to 89°. Very little $Pr^\beta OH$ is formed. Above 0° an exchange reaction between $COMe_2$ and D_2 occurs simultaneously with the reduction, but this reaction ceases below $-10°$. The reduction of $Pr^\beta OH$ to C_3H_8 by D_2 is slower than that of $COMe_2$ under the same experimental conditions. An exchange reaction is also observed which proceeds by two stages : the H atoms of the $>CH·OH$ group are exchanged, and subsequently those of the Me groups. The assumption of three independent reactions is sufficient to explain the different reduction and exchange reactions occurring in the system $COMe_2$–$Pr^\beta OH$–D_2 : (a) reduction of $COMe_2$ to C_3H_8, (b) establishment of the equilibrium $CHMe_2·OH \rightleftharpoons COMe_2 + H_2$, and (c) the exchange reaction of $COMe_2$ with D_2. W. R. A.

Homogeneous catalytic formation of mono- and di-vinylacetylene from acetylene. H. Schmitz and H. J. Schumacher (Z. Elektrochem., 1939, **45**, 503—517).—The polymerisation of C_2H_2 to mono- (I) and di-vinylacetylene (II), catalysed by various mixtures of HCl, NH_4Cl, and Cu_2Cl_2, has been studied at total pressure 1—2·5 atm. and at 60—110° by a circulation method. The total yield of polymerides increases with increasing rate of stirring of the solution (r), but the yield of (II) decreases both with increasing r and with increasing rate of passage of the gas (v). Beyond certain min. vals. of r and v, however, the total yield of polymerides and the proportions of (I) and (II) become approx. const. for any particular catalyst mixture, the total yield being $\propto$ the partial pressure of C_2H_2, i.e., $\propto$ the $[C_2H_2]$ in the solution. With const. $[C_2H_2]$ the yield is also $\propto$ the $[Cu_2Cl_2]$. Replacement of NH_4Cl by NH_4Br reduces the yield considerably, apparently owing to the formation of Cu_2Br_2, which is less active than Cu_2Cl_2. The yields of (I) and (II) are unaltered by mixing the C_2H_2 with CO, CH:CCl, or CH_2O or by adding $FeCl_3$ to the catalyst. The relative yields of (I) and (II) are also unaltered by covering the solution with xylene, which is a good solvent for (I). In contact with a solution containing Cu_2Cl_2, C_5H_5N, and AcOH, C_2H_2 appears to undergo a different form of polymerisation of undetermined nature. J. W. S.

Catalysis. L. D. Johnson (J. Chem. Educ., 1939, **16**, 238—239).—Apparatus and method for demonstrating the oxidation of MeOH to CH_2O using CuO as catalyst are described. L. S. T.

Isomerisation of alkenes on alumina and thoria. S. Goldwasser and H. S. Taylor (J. Amer. Chem. Soc., 1939, **61**, 1762—1765).—The comparative rates of isomerisation of several olefines have been measured on ThO_2 and Al_2O_3 catalysts at $\sim$400°, and the products of the isomerisation determined. The mode of prep. affects only the physical state of the catalyst and has no appreciable effect on the isomerisation. At this temp. the straight-chain olefines are the most unstable, Δ^α-hexene and Δ^α-heptene giving a large no. of isomerides on Al_2O_3. C_7 olefines iso-

merise faster than C_6 olefines. The main isomerisation observed is the migration of a Me group across a double bond. All β-Me compounds give the corresponding γ-Me compound in large amounts, but the reverse migration occurs only to a slight extent. A mechanism postulating an intermediate three-ring structure similar to that proposed for the dehydration of alcohols (cf. A., 1939, II, 401) accounts for the products of isomerisation.   W. R. A.

Aromatisation of heptane, heptene, and hexene isomerides on chromic oxide. S. GOLDWASSER and H. S. TAYLOR (J. Amer. Chem. Soc., 1939, 61, 1766—1769).—The dehydrogenation of cyclo-hexene and -hexadiene on Cr_2O_3 gel surfaces has been investigated. The effect of temp. and treatment of the catalyst on the yield of C_6H_6 has been studied. The fastest rate of conversion of n-C_7H_{16} into PhMe on Cr_2O_3 gel is 9 c.c. per hr. With ThO_2 and Al_2O_3 catalysts there is no aromatisation, indicating the difference between dehydrogenating and isomerising catalysts. The influence of structure of olefines on poisoning, aromatisation, and disproportionation has been demonstrated.   W. R. A.

Mechanism of polymerisation reactions. I. Polymerisation of styrene and methyl methacrylate. R. G. W. NORRISH and E. F. BROOKMAN (Proc. Roy. Soc., 1939, A, 171, 147—171).—The rate of polymerisation of $CH_2{:}CMe{\cdot}CO_2Me$ and styrene has been measured, with and without catalyst, in the temp. range 80—130°. The rate of co-polymerisation of the two substances was also investigated. The change of mol. wt. during the course of polymerisation of the pure substances was measured. In the absence of catalyst the rate of polymerisation is slow and is believed to be due to the presence of adventitious catalysts. It is concluded that the reaction is started by free radicals derived from the catalyst, and is propagated by way of a free valency at the end of the growing chain. The growth of the chain may be terminated by hydrogenation at the expense of the monomeride, resulting in the starting of a new chain by the monomeric free radical thus produced.
                    G. D. P.

Comparison of the catalytic activities of the two allotropic forms of nickel. G. LE CLERC and H. LEFEBVRE (Compt. rend., 1939, 208, 1650—1651). —Reduction of CO by H_2 in presence of cubic Ni is retarded at 170°, and eventually ceases owing to the production of the hexagonal form (A., 1939, I, 428). C_6H_6, C_2H_2, and $COMe_2$ are not reduced in presence of hexagonal Ni. The catalytic activity is restored by heating at 250° to re-form cubic Ni. The inactivity of the hexagonal form may be related to its non-ferromagnetic properties.   A. J. E. W.

Contact sulphuric acid manufacture.—See B., 1939, 821.

Heterogeneous catalysis of sulphonation of benzene with sulphur trioxide.—See B., 1939, 804.

Elimination of acetylene from gases.—See B., 1939, 799.

Catalysts for synthesis of liquid hydrocarbons. —See B., 1939, 803.

Separation of the isotopes of chlorine by electrolysis. K. V. YACOUBYAN (Helv. Chim. Acta, 1939, 22, 808—809).—By electrolysis of a mixture of HCl and NaCl containing initially 36 kg. of Cl′, 24 g. of Cl′ of at. wt. 0·016 > that of normal Cl have been obtained.   J. W. S.

Silver–silver carbonate electrode obtained by electrolysis. P. DEMERS (Canad. J. Res., 1939, 17, A, 77—81).—The electrode is made by using a Ag anode in the electrolysis of dil. $NaHCO_3$ solution. Immersion of the Ag_2CO_3-coated electrode in a Na_2CO_3–$NaHCO_3$ solution gives a reproducible potential of −0·4679 v. and a solubility product of $1·27 \times 10^{-11}$.   D. F. R.

Preparation of lanthanum by electrolysis of its fused chloride. F. WEIBKE [with J. SIEBER] (Z. Elektrochem., 1939, 45, 518—520).—Pure La_2O_3 (x g.) is dissolved in the theoretical vol. of conc. HCl and NH_4Cl (1—1·5x g.) is added. The solution is stirred vigorously while it is evaporated to dryness. The residue is powdered finely and heated slowly to expel most of the NH_4Cl. Electrolysis is carried out in a graphite crucible within which is enclosed an Al_2O_3 crucible to separate the anode and cathode compartments. The graphite crucible serves as anode and a rotating Mo rod as cathode. KCl and CaF_2 are added to the $LaCl_3$ as fluxes. Optimum yields are obtained by electrolysis at 1000° with c.d. 7 amp. per sq. cm.   J. W. S.

Electrodeposition of a thin layer of powdered substances. J. H. DE BOER, H. C. HAMAKER, and E. J. W. VERWEY (Rec. trav. chim., 1939, 58, 662—665).—The finely-ground substance is suspended in MeOH, EtOH, BuOH, or $COMe_2$, and deposited by electrophoresis. High voltages may be used.
                    F. J. G.

Principles of the genetic formation of materials. XII. Cathodic deposition of metals in solid electrolytes. V. KOHLSCHÜTTER and E. STOCKER (Helv. Chim. Acta, 1939, 22, 869—894).— The crystal forms of the metals deposited by electrolysis of solid $PbCl_2$, $PbBr_2$, PbO, AgCl, and α-AgI have been examined. Difference in behaviour is observed according as the potential used is ∼ 60 v. or >500 v. When the electrodes used are unattacked the current–p.d. curve for $PbCl_2$ obeys Ohm's law if the p.d. is > the decomp. potential.   J. W. S.

Electrolytic production of very pure nickel from alloys. G. G. MONSELISE (Helv. Chim. Acta, 1939, 22, 935—937).—The alloy (>60% Ni) is dissolved anodically at 60° in a solution which is maintained at p_H 0 by addition of H_2SO_4, using a c.d. of 10 amp. per sq. dm. Under these conditions most of the Cu is deposited at the Pb cathode. To the solution is added sufficient MnO_2 to oxidise all the Fe to Fe^{III} and the H_2SO_4 is neutralised by addition of $CaCO_3$. After filtration the solution should be free from Fe and Cu. It is finally electrolysed at 75—90° between a graphite anode and a pure Ni cathode, with a c.d. of 6—8 amp. per sq. dm., the solution being maintained neutral by addition of $CaCO_3$. A pure adherent and homogeneous deposit of Ni is formed.   J. W. S.

Electrolytic preparation of manganese. I. P. B. SHIVOTINSKI and S. A. ZARETZKI (J. Appl. Chem. Russ., 1939, **12**, 200—208).—Mn is obtained by electrolysis of solutions containing $MnCl_2,4H_2O$ 350 g. and NH_4Cl 100 g. per l., in $0.03N$-HCl, at 10—25° and p_H 1·2—1·3 (Fe, Cu, or Al cathode, graphite or Pt anode, with alundum diaphragms; c.d. 250—1000 amp. per sq. m.), or $MnSO_4$ 80, $(NH_4)_2SO_4$ 150, and SO_2 0·05—0·4 g. per l., at 20—30° and p_H 4—7 (cathode Fe, anode Pt or graphite, with linen or porcelain diaphragms; c.d. 200—750 amp. per sq. m.). R. T.

Influence of titanium salts on electrolytic reduction of ferric sulphate. K. J. GRATSCHEV (J. Appl. Chem. Russ., 1939, **12**, 196—199).—Electrolytic reduction of $Fe_2(SO_4)_3$ to $FeSO_4$ is considerably accelerated by addition of $TiOSO_4$ (5 g. TiO_2 per l. of solution). R. T.

Electrolytic oxidation. XI. Electrolysis of acid–ester salts in non-aqueous solutions, and the mechanism of the Crum-Brown–Walker synthesis. A. HICKLING and J. V. WESTWOOD (J.C.S., 1939, 1109—1114).—The efficiency, E, of the electrosynthesis of $(CH_2\cdot CO_2Et)_2$ from $CO_2Et\cdot CH_2\cdot CO_2K$ in $(CH_2\cdot OH)_2$ is $<$ for aq. solutions and appears to be only slightly affected by changes in c.d. or in the material of the anode. E falls approx. linearly with the addition of H_2O to $(CH_2\cdot OH)_2$. Metallic salts which inhibit the synthesis in aq. solution have a negligible effect in $(CH_2\cdot OH)_2$. $CO_2Et\cdot CH_2\cdot CO_2'$ ions directly discharged at the anode are supposed to combine to form $(CO_2Et\cdot CH_2\cdot CO\cdot O\cdot)_2$ which decompose to $(CH_2\cdot CO_2Et)_2$ and CO_2 or else react with $(CH_2\cdot OH)_2$ to form $CHO\cdot CH_2\cdot OH$ and $CO_2Et\cdot CH_2\cdot CO_2H$. Experiments on the thermal decomp. of $(CO_2Et\cdot CH_2\cdot CO\cdot O)_2$ and its reaction with $(CH_2\cdot OH)_2$ support this view. C. R. H.

Application of electrolytic polishing to micrographic examination of iron and steels.—See B., 1939, 845.

Electrochemistry of rare metals.—See B., 1939, 845.

Anodic oxidation of copper and brass.—See B., 1939, 845.

Emission of ultra-violet radiation by electrolysis of solutions of azoimide and sodium azide. R. AUDUBERT and E. T. VERDIER (Compt. rend., 1939, **208**, 1984—1986).—Measurements with a CuI photon counter show that ultra-violet radiation of intensity given by $J = aIe^{aV}$ is emitted from the anode during electrolysis of 0·5—1·5M-HN_3 and 0·2—0·6M-NaN_3. As the p_H rises, the const. α first decreases and may become negative ($p_H \sim 7$), and then increases. The influence of the anode potential, V, on J indicates that the activation energy of the N_3 radicals, which undergo secondary photogenic reaction, is partly determined by kinetic activation by the electric field. The emission bands correspond with those observed during pyrolysis of azides (A., 1939, I, 481), and the emission is due to an electronically activated N_2 group (which possibly has a metastable state of long life) returning to its normal state. A. J. E. W.

Volume and surface processes in the oxidation of nitrogen in glow discharge. I. B. A. KONOVALOVA and N. I. KOBOZEV (J. Phys. Chem. Russ., 1938, **12**, 521—540).—At a pressure of 4 mm. Hg the rate of oxidation of dry N_2 by O_2 shows a max. at 80% N_2. H_2O decreases the rate between 45 and 95% of N_2 and increases it at other $[N_2]$; 2% of H_2O is as active as 1%. CH_4 inhibits the reaction $>$, and NH_3 and H_2 $<$, H_2O. An increase of the solid surface (quartz, glass, or mica) accelerates the oxidation, especially in the presence of H_2O. It is supposed that NO is produced partly on the walls, this part of the reaction being inhibited by dipole mols., and partly in space. H_2O or NH_3 does not affect the latter part since they do not alter the emission spectrum of the discharge. J. J. B.

Optical sensitising of silver halides by dyes. II. Mechanism of optical sensitising and the quantum equivalent. S. E. SHEPPARD, R. H. LAMBERT, and R. D. WALKER (J. Chem. Physics, 1939, **7**, 426—436; cf. A., 1939, I, 315).—The photolysis of AgBr sensitised with certain acid and basic dyes has been followed by the chemical and photometric determination of the liberated Ag. In absence of halogen acceptors the dye is progressively bleached, whilst in presence of halogen acceptors the dye is unaffected. The max. sensitivity is considerably $<$ adsorption saturation and at approx. the same adsorption density for both photolysis and photographic sensitivity. At higher adsorption densities a desensitising action of sensitising dyes is due to the ease of rebromination by the dye–Br additive compound. The initial quantum equiv. is 1 if the photographic yield $\propto$ the adsorption density of the dye. In sensitising, photovoltaic experiments indicate the release of photoconductance electrons (from the adsorbed dye, or from the Br' ions of the AgBr receiving energy from the photo-activated dye). W. R. A.

Photographic latent image from the standpoint of the modern theory of solids. J. H. WEBB (Proc. Sixth Conf. Spectros., 1938, 157—167).—The theory of latent image formation proposed by Gurney and Mott is reviewed. The theory is tested experimentally. The effect of low temp. on the sensitivity of an emulsion has been investigated. At $-186°$ the sensitivity is $\ll$ at room temp. The breaking up of an exposure into a no. of smaller ones, with intermittent warming up from $-186°$ to room temp., increases the sensitivity almost to that at room temp. This is strong evidence in support of the Gurney–Mott assumption that electrolytic transport of Ag˙ constitutes the secondary process of latent image formation. The Herschel effect (erasure by infra-red light of the action of previous exposure to white light) has been investigated at various temp. If a white light exposure is made at 20°, followed by a Herschel exposure at $-186°$, no Herschel effect was obtained, but when the white light exposure is made at $-186°$, and the Herschel exposure at 20°, the Herschel effect is considerable. These facts can be readily explained on the Gurney–Mott theory, which also offers a plausible explanation of the failure of the

reciprocity law at high intensity. The degree of failure diminishes as the temp. is lowered.   A. J. M.

Sensitivity of photographic films to X-radiation at very low temperatures. J. REEKIE (Proc. Physical Soc., 1939, **51**, 683—688).—Investigations at temp. obtainable with liquid N_2, H_2, and He indicate that the sensitivity decreases uniformly down to ~$100°$ K., below which the decrease becomes less rapid until at temp. $<20°$ K. the sensitivity remains almost const. at a val. $\gg$ that found for visible light (cf. Berg, A., 1939, I, 89). It is suggested that the relatively high X-ray val. indicates that a considerable no. of free electrons must be formed by the absorption of the X-radiation while the film is at low temp.   N. M. B.

Interpretation of the mechanism of a thermal decomposition from photochemical evidence. H. A. TAYLOR and M. BURTON (J. Chem. Physics, 1939, **7**, 414—417).—A transition in polyat. mols. permitted between two energy hypersurfaces in a radiative act is forbidden (by analogy with diat. mols.) in a non-radiative process. The thermal decomp. of MeCHO into CH_4 and CO in a unimol. primary process is hence not allowed, and for CH_4 and CO to be formed in a primary process it must be in a reaction of the type MeCHO $+ M \rightarrow CH_4 + CO + M$, where $M =$ another mol. or an external field. The simultaneous occurrence of such a decomp. and a free radical decomp. adequately accounts for many of the observations on the catalysed and high-pressure reactions.   W. R. A.

Reactions of methyl radicals with deuterium, ethane, neopentane, butane, and *iso*butane. J. O. SMITH, jun., and H. S. TAYLOR (J. Chem. Physics, 1939, **7**, 390—396).—Me radicals, produced by the photolysis of $HgMe_2$, were allowed to react with D_2, C_2H_6, n-C_4H_{10}, *iso*-C_4H_{10}, and CMe_4 and the amounts of CH_4 and C_2H_6 formed have been determined. The plot of log k_{CH_4} against $1/T$ is a straight line for all the reactions ($k_{CH_4} =$ rate of formation of CH_4). In the interaction between $HgMe_2$ and H_2 or D_2, both in absence and in presence of H_2 or D_2, the formation of C_2H_6 remains unchanged; formation of CH_4 increases with temp. and so does the rate of decomp. of $HgMe_2$. Formation of C_2H_6 shows first-order dependence on light intensity, whilst formation of CH_4 shows an order between one-half and the first power, tending towards the first power with increased temp. Packing the vessel at $200°$ decreases the amount of CH_4 formed but does not affect the amount of C_2H_6, and the rate of decomp. of $HgMe_2$ is independent of its concn. A mechanism which satisfies all these facts is put forward. For the reactions with hydrocarbons the suggested mechanism is (i) Me $+$ RH $=$ $CH_4 +$ R; (ii) R $+$ Me $=$ RMe; (iii) Me $+$ Me $=$ C_2H_6. From the rate of formation of CH_4 the following activation energies for the reaction of Me with hydrocarbons have been deduced, assuming zero activation energy for C_2H_6 formation : C_2H_6 and CMe_4, 8·3; n-C_4H_{10}, 5·5; *iso*-C_4H_{10}, 4·2 kg.-cal. The differences in activation energies are attributed to differences in bond energies, particularly because of the closely analogous differences in the heats of hydrogenation

of substituted ethylenes (Kistiakowsky *et al*, A., 1938, I, 199).   W. R. A.

Conversion of light into chemical energy. E. RABINOWITCH (Proc. Sixth Conf. Spectros., 1938, 143—149).—Examples of photochemical reactions in which light is converted into chemical energy are given. The extent of such conversion in org. reactions is small, but may be considerable in ionic reactions such as the formation of the latent image in a AgBr–gelatin emulsion. Reactions of inorg. compounds in the extreme ultra-violet often show a 50% conversion of light into chemical energy. The most efficient process of conversion is met with in C assimilation, where it reaches 70—80%. This high degree of conversion is remarkable, since the reaction must occur by the successive absorption of 4 quanta, and with the formation of three intermediate products. Reasons for the failure to bring about photosynthesis *in vitro* are discussed. Sensitisation, catalysis, and quantum accumulation by resonance transfer assist in the efficient utilisation of light energy. Reversible photochemical reactions are also considered.   A. J. M.

Photochemistry of the visual spectrum. F. WEIGERT (Proc. Sixth Conf. Spectros., 1938, 134—142).—The phenomenon of photodichroism is discussed. It is due to the presence of minute dichroic and light-sensitive particles which are affected selectively when their optic axes are oriented to correspond with vibrations of polarised light. Film dichroism, observed in coloured collodion films, is also discussed. Experiments on film dichroism and its variation after exposure of the film to natural light show that there are two types of dichroic particles. In the first type the anisotropic and dichroic properties are forced on the dye particles by the binding medium (collodion, gelatin), whereas in the second type the dichroism is independent of the medium. The dichroism of AgCl–gelatin and AgBr–gelatin emulsions with a slight excess of Ag· is discussed. The sp. action of coloured light on AgCl emulsions is due entirely to the presence of dichroic particles of the second type.   A. J. M.

Photo-oxidation of hydrocarbon solutions. E. J. BOWEN and A. H. WILLIAMS (Trans. Faraday Soc., 1939, **35**, 765—771).—Fluorescence efficiencies and fluorescence quenching by O_2 (cf. A., 1939, I, 123) have been compared with the quantum efficiencies of photo-oxidation for 17 aromatic hydrocarbons dissolved in C_6H_{14}, C_6H_6, or m-xylene. Quenching and oxidation represent similar processes in C_6H_6, all Me-substituted C_6H_6 except C_6Me_6, and rubrene, whilst in the others the oxidation efficiency is $\ll$ the fluorescence quenching would indicate.   F. L. U.

Emission of ultra-violet radiation and pyrolysis of thallium azide. R. AUDUBERT and C. RACZ (Compt. rend., 1939, **208**, 1810—1811; cf. A., 1938, I, 431).—Radiation is not emitted by TlN_3 during pyrolysis in N_2. In 2—10 mm. of O_2, radiation commences at $206\pm5°$; the activation energy of the photogenic process is 43,000 or 21,600 g.-cal. for temp. $<$ and $>228\pm8°$, respectively. With O_2 pressures >10 mm., radiation commences at $267\pm3°$, and the activation energy is 65,800 g.-cal., the process evidently

involving oxidation of Tl. No emission is observed during oxidation of Tl, and the radiation is thus due to the N; the emission bands [2040, 2140, 2280, 2390, 2500, 2650 (?) A.] correspond with excited levels of the N_2 mol. Tl inhibits the photogenic reaction.
A. J. E. W.

Splitting of protein molecules by ultra-violet light and α-rays.—See A., 1939, III, 868.

Detonation of nitrogen iodide under the action of α-rays from polonium. M. HAÏSSINSKY and R. J. WALEN (Compt. rend., 1939, **208**, 2067—2069).— N iodide (I) detonates on exposure to Po after a period which increases rapidly as the intensity of the source is reduced, and is decreased by drying the specimen. $Pb(N_3)_2$, AgN_3, and diazo-*m*-nitroaniline perchlorate are not detonated. Detonation is due to local heating of favoured (I) particles by the α-rays, the particle size being an important factor in determining the resulting temp. rise. A. J. E. W.

Molecular compounds—inorganic and organic. J. S. ANDERSON (J. Proc. Austral. Chem. Inst., 1939, **6**, 232—242).—A review.

Chemical separation of the isotopes of hydrogen. L. H. REYERSON, O. JOHNSON, and C. BEMMELS (J. Amer. Chem. Soc., 1939, **61**, 1594—1595).— Separation of H_2 and D_2 has been carried out by the action of H_2O of various D_2 content on CaC_2 in an all-glass apparatus which is described (cf. A., 1936, 427). W. R. A.

Improved universal buffer. W. C. JOHNSON and A. J. LINDSEY (Analyst, 1939, **64**, 490—492).— 6·008 g. of citric acid, 3·893 g. of KH_2PO_4, 1·769 g. of H_3BO_3, and 5·266 g. of diethylbarbituric acid form a solid mixture to be made up to 1 l. with H_2O. Solutions of any p_H between 2·6 and 12·0 may be prepared by titrating with 0·2N-NaOH free from CO_3''.
E. C. S.

Preparation of potassium iodide by double decomposition.—See B., 1939, 822.

Hydrates of cupric oxide. O. BINDER (Compt. rend., 1939, **208**, 1995—1998; cf. A., 1923, ii, 321).— Differential thermal analysis of CuO,H_2O gives no indication of endothermic dehydration reactions yielding other hydrates, the only marked heat absorption occurring on decomp. CuO,H_2O, which is stable in absence of alkali, is thus the only definite hydrate (cf. A., 1932, 238; 1938, I, 366).
A. J. E. W.

Formation of copper ferrite at low temperature. H. FORESTIER and (MLLE.) J. LONGUET (Compt. rend., 1939, **208**, 1729—1730).—Microcryst. Fe_2O_3,CuO, possessing normal ferromagnetic properties, with a Curie point at 455°, is obtained by boiling the pptd. hydroxides with H_2O for ~24 hr. The reaction does not occur in absence of H_2O, or with partly dehydrated or cryst. hydroxides.
A. J. E. W.

Trifluoroacetates. F. SWARTS (Bull. Soc. chim. Belg., 1939, **48**, 176—191; cf. A., 1923, i, 292).— $CF_3 \cdot CO_2Na$ (I) and $CuSO_4,5H_2O$ [or $Cu(NO_3)_2$], followed by extraction with Et_2O, gives *Cu trifluoroacetate* $[(CF_3 \cdot CO_2)_2Cu]_2$, very hygroscopic (*dihydrate* formed in moist air); evaporation of an aq. solution

at 100° (bath) gives insol. basic salts (II). The Et_2O extract of a solution conc. under reduced pressure, and pptd. with light petroleum, affords a ppt., which when dried and treated with H_2O, or extracted with dioxan, gives a residue of the *complex*, $(CF_3 \cdot CO_2)Cu,3CuO,H_2O$, or $[(CF_3 \cdot CO_2)_3OH]Cu_2$, respectively; the latter is obtained also from (I) and dioxan (as residue). (I) and $AgNO_3$ give $CF_3 \cdot CO_2Ag$ (*loc. cit.*), which with C_6H_6 affords $(CF_3 \cdot CO_2Ag)_2,C_6H_6$. Hg_2CO_3 and $CF_3 \cdot CO_2H$ (III), or (I) and $HgNO_3$, give $(CF_3 \cdot CO_2)_2Hg_2$. (III) and HgO give $(CF_3 \cdot CO_2)_2Hg$ (IV); the *dihydrate* at 105° gives $(CF_3 \cdot CO_2)_2Hg,HgO$. (IV) and hot C_6H_6 give *HgPh trifluoroacetate*, $CF_3 \cdot CO_2HgPh$, m.p. 123·7°. (III) and Tl_2CO_3 give Tl^I trifluoroacetate, m.p. 120·5°, b.p. ~160°/1·5 mm. (liquid phases with C_6H_6 are examined). $(CF_3 \cdot CO_2)_2Ba,3H_2O$ (V) and $Al_2(SO_4)_3$ [with some (III)] give $(CF_3 \cdot CO_2)_2AlOH$; the neutral salt was not obtained. (III) and PbO give an impure Pb trifluoroacetate. (V) and $FeSO_4$ (evaporated in H_2) give $(CF_3 \cdot CO_2)Fe$ (*trihydrate*). (III) and $Fe(OH)_3$ afford $[CF_3 \cdot CO_2)_6(OH)_2Fe_3]CF_3 \cdot CO_2$ (VI), which loses H_2O to give $CF_3 \cdot CO_2[Fe(CF_3 \cdot CO_2)_6O]$. The orange-red aq. solution of (VI) is decolorised by adding (III). (III), pure or a conc. solution, and (VI) give a complex trifluoroacetate. Solutions of (VI) are decomposed by ultra-violet light (mechanism suggested). Ni (+ $5H_2O$) and nitron trifluoroacetates are recorded.
A. T. P.

Reactions of beryllium chloride. Normal and basic organic salts of beryllium. G. B. FIELD (J. Amer. Chem. Soc., 1939, **61**, 1817—1820).—A mixture of 500 g. of sucrose and 50 g. of BeO was evaporated until it became a viscous syrup. This was ignited and allowed to burn without further heating. The residue, BeO + C, was crushed and placed in a Pyrex reaction chamber embedded in an electric furnace. Preheated Cl_2 (admixed with an equal vol. of N_2) was passed over the BeO–C mixture and reaction took place at ~550°. Anhyd. $BeCl_2$ passed over as a smoke. Anhyd. $BeCl_2$ reacts, in dry C_6H_6, with org. acids or acid anhydrides to give the normal salts, $(RCO_2)_2Be$, if H_2O is rigorously excluded. Even traces of H_2O cause hydrolysis to the basic salt, $(RCO_2)_6Be_4O$, according to the equation $4(RCO_2)_2Be + H_2O = (RCO_2)_6Be_4O + 2RCO_2H$. The following have been prepared : normal formate, m.p. 150° (decomp.), acetate, m.p. 294— 296° (decomp.), propionate, m.p. 75—78° (decomp.), *benzoate*, m.p. 307—309° (decomp.), and *o*-*chlorobenzoate*, m.p. 245—249° (decomp.); basic formate, glassy, acetate, tetrahedral, m.p. 283—284°, propionate, monoclinic prismatic, m.p. 133—134°, butyrate, b.p. 225°/25 mm., *benzoate*, pinacoidal triclinic, m.p. 317—318°, and *o*-*chlorobenzoate*, prisms, m.p. 255— 256°. W. R. A.

Beryllium chloride in organic reactions.—See A., 1939, II, 411.

Ammoniacal calcium phosphide, $Ca(PH_2)_2,6NH_3$. C. LEGOUX (Compt. rend., 1939, **209**, 47—49; cf. A., 1938, I, 633).—A known vol. of PH_3 was bubbled into a dil. solution of Ca in liquid NH_3 at —70°. A white microcryst. ppt. (I) was formed with liberation of H_2. Qual. and quant.

analysis of the gas liberated by (I) at 0° indicates 1 mol. of H_2. (I) is therefore $Ca(PH_2)_2,nNH_3$. Contrary to the behaviour of the K, Na, and Li compounds, (I) is scarcely sol. in liquid NH_3. It is spontaneously inflammable in air. Attacked by air-free H_2O or by dil. HCl in vac. it gives off 2 mols. of PH_3 (not spontaneously inflammable). It has a dissociation pressure in liquid NH_3 of 46 mm. Hg at 0°. At this pressure it gives off 4 mols. of NH_3, leaving an amorphous white powder (II). This is also spontaneously inflammable and is attacked by excess of dil. HCl in vac. liberating 2 mols. of PH_3 with formation of $CaCl_2$ and NH_4Cl (2 mols.). (I) is thus $Ca(PH_2)_2,6NH_3$ and (II) $Ca(PH_2)_2,2NH_3$. (II), which has no appreciable pressure at ordinary temp., decomposes above 45° with liberation of NH_3 and PH_3.
W. R. A.

Water softening.—See B., 1939, 788.

Separation of liquid mixtures in the Clusius separation tube. (Separation of zinc isotopes.) H. KORSCHING and K. WIRTZ (Naturwiss., 1939, 27, 367—368).—An improved apparatus for the separation of liquids by the method of Clusius involving thermo-diffusion is described. The efficiency of the method when applied to the separation of various types of liquid mixture is examined. The application of the method to the separation of a mixture of 50% C_6H_{14} and 50% CCl_4 is described, the difference in concn. (Δn) of CCl_4 at the upper and lower ends of the tube being determined at different times (t). At first $\Delta n \propto t^{\frac{1}{2}}$, but the curve rapidly becomes flatter, although a limiting val. is not reached. For a tube of length h, $\tau = h^2/\pi^2 D$, where D is the diffusion const. and τ the time required to attain equilibrium. The separation of H_2O–D_2O mixtures is also considered. The sedimentation of salts in aq. solution can also be effectively carried out with the apparatus, and the method is applied to the separation of $^{64}ZnSO_4$, $^{66}ZnSO_4$, and $^{68}ZnSO_4$. Although the time during which the separation was carried out was short, a definite separation was effected and confirmed spectroscopically. The separation of heavy mols. from light ones is shown to be possible by the partial separation of Sudan I (mol. wt. ~350) from CCl_4, and of chlorophyll (mol. wt. ~1000) from H_2O.
A. J. M.

Aluminium silicofluoride. A. A. SANFOURCHE and A. KRAPIVINE (Compt. rend., 1939, 208, 2080—2082).—$Al_2(SiF_6)_3,9H_2O$ is obtained in small yield by treating aq. $PbSiF_6$ with neutral aq. $Al_2(SO_4)_3$; traces of Pb are removed from the filtrate by H_2S and the solution is evaporated at room temp., any pptd. SiO_2 being removed. (I) forms hexagonal prisms which twin readily and resemble cryst. Na_2SiF_6; $3H_2O$ are lost at >300°, and decomp. commences at 500°. Aq. (I) is acid, and decomposes when heated or neutralised.
A. J. E. W.

Action of water vapour on amalgamated aluminium. M. BLUMENTHAL (Bull. Acad. Polonaise, 1938, A, 466—477).—The surface of an amalgamated Al sheet is not homogeneous and the reaction with water vapour takes place on active centres. The activity of the centres depends on the structure and composition of the solid phase. The product is

$(Al_2O_3,3H_2O),(n-3)H_2O$. If n is <3 the centres become passive and the reaction can be completely arrested. Below 75° the temp. coeff. is negative owing to the slow adsorption of H_2O vapour. At temp. >75°, however, the mean energy of the active centres increases and the temp. coeff. becomes positive.
W. R. A.

Bi- and quadri-valent compounds of the rare earths. IX. Ytterbous [selenide and telluride]. H. SENFF and W. KLEMM (Z. anorg. Chem., 1939, 242, 92—96).—Yb^{II} *telluride*, YbTe, and *selenide*, YbSe, have been obtained by heating $YbCl_2$ with excess of Te or Se in a stream of H_2. They are black powders, which are slowly oxidised by moist air. They have the NaCl structure, with a 6·340 A. for YbTe and 5·867 A. for YbSe. The radius of the $Yb^{\cdot\cdot}$ ion is therefore ~ that of the $Ca^{\cdot\cdot}$ ion. Attempts to obtain Sm^{II} telluride by the same method gave products containing only ~25% of Sm^{II}.
F. J. G.

Cobalticyanides of the rare earths; preparation and magnetic properties. T. KARANTASSIS, C. VASSILIADIS, and N. PERAKIS (Compt. rend., 1939, 208, 1720—1721).—$M^{III}[Co(CN)_6]$ (M = La, Ce, Pr, Nd, Sm, Yb, or Yt) is pptd. on adding $K_3[Co(CN)_6]$ or the acid to aq. MCl_3 or $M(NO_3)_3$. Solubilities in H_2O and 0·1N-HCl at 18° are given, and vals. of χ and χ_A at 79—295° K. are recorded. The Curie points are: M = Ce, $-58°$; Pr, $-62°$; Nd, $-59°$. The at. moments are 11·8, 16·0, and 17·5 Weiss magnetons, respectively.
A. J. E. W.

Preparation of cyanogen iodide. H. T. COMASTRI (Anal. Asoc. Quim. Argentina, 1939, 27, 45—47).—I with aq. KCN gives an 86% yield of CNI, m.p. 149° (sealed tube).
F. R. G.

Reaction of carbonic acid with the zeolite in a water softener.—See B., 1939, 788.

Action of sulphides on very dilute solutions of permanganate. E. MONTIGNIE (Bull. Soc. chim., 1939, [v], 6, 1191—1195).—Pptd. PbS, HgS, Bi_2S_3, SnS_2, CdS, CoS, CuS, ZnS, and UO_2S all react rapidly with dil. aq. $KMnO_4$, yielding the oxide of the metal, K_2SO_4, and hydrated MnO_2. The reaction is accelerated by agitation and by addition of small amounts of acid. Only slow decolorisation of the $KMnO_4$ is produced by As sulphides formed by the wet method and by SnS_2 formed by fusion of Sn with S. No reaction is observed with FeS, ZnS, Sb_2S_3, or HgS formed by the dry method or with MnS, SnS, Ag_2S, WS_3, and MoS_3 produced by pptn.
J. W. S.

Action of liquid ammonia solutions of sodium, potassium, and potassium amide on bismuth oxyiodide. G. W. WATT and W. C. FERNELIUS (J. Amer. Chem. Soc., 1939, 61, 1692—1694).—Liquid NH_3 solutions of Na and K at room temp. reduce BiOI according to $BiOI + 3M + NH_3 \rightarrow Bi + MI + MOH + MNH_2$ (M = Na, K). Excess of M causes the formation of bismuthides. KNH_2 reacts thus: $BiOI + KNH_2 \rightarrow BiONH_2 + KI$.
W. R. A.

Thermal method for the separation of isotopes. A. BRAMLEY and A. K. BREWER (J. Chem. Physics, 1939, 7, 553—554).—Separation chambers of concentric glass tube design 1 m. and 3 m. long were used to study the isotope separation of a 50% NH_3–

CH_4 mixture at 25 cm. pressure. The change in the separation factor (f) (the ratio of the initial to final concn.) for a definite time is independent of the height of the tube if separation is $<90\%$ of the final equilibrium concn. The final equilibrium val. of f is $\propto$ the height of the tubes. For the 3-m. tube the variation in separation at different heights indicates that the ratio of concns. of the two components is const. for several cm. from the bottom but that for greater distances f alters considerably. The mass speed is independent of tube length. f is not changed by withdrawing 8 c.c. (at n.t.p.) of gas per hr. For the 1-m. and 3-m. tubes f is 1·3 and 2·0 respectively. Addition of an inert gas of the same mass to give initially a 50% (mass) mixture leads to increased efficiency of separation of a component of low concn. In the NH_3–CH_4 mixture $^{13}CH_4$ has the same val. of f as $^{14}NH_3$.   W. R. A.

Vanadium selenides. E. Hoschek and W. Klemm (Z. anorg. Chem., 1939, **242**, 49—62).—By heating V_2O_3 in a stream of H_2 containing H_2Se, followed by further heat-treatment in a vac. or with excess of Se, V *selenides* ranging in composition from VSe to $VSe_{1.97}$ have been obtained, and their crystal structures and magnetic properties studied. They are stable in air, and resistant to acids except to HNO_3, which attacks them violently. In vac. at 1000° they lose Se until the composition VSe is attained. There are three phases : preps. from VSe to $VSe_{1.13}$ belong to the α-phase, of NiAs type ; those from $VSe_{1.25}$ to $VSe_{1.60}$ to the β-phase, which has a related but less symmetrical structure ; and those from $VSe_{1.62}$ to $VSe_{1.97}$ to the γ-phase, of CdI_2 type. The lattice consts. range from a 3·58, c 5·98 A. for $VSe_{1.04}$ to a 3·35, c 6·12 A. for $VSe_{1.97}$. The transition from the NiAs to the CdI_2 structure, usually through an intermediate structure of lower symmetry, is of general occurrence among analogous compounds, and can be interpreted by reference to structure diagrams. The NaAs structure can be derived from the CdI_2 structure by insertion of an additional plane of metallic ions ; when this process has not gone too far the structure is still essentially a CdI_2 structure, then, at a certain stage of completion of the additional plane, a structure of lower symmetry results, and finally the NiAs structure is obtained as the additional plane approaches completion. This view is supported by consideration of the course of the lattice consts., and of the vals. for ρ_4^{25} which ranges from 5·94 for $VSe_{1.04}$ to 5·79 for $VSe_{1.97}$. The mol. vols. correspond with at. binding. The preps. are all paramagnetic ; ferromagnetism does not occur, and χ has a sharp max. at the composition V_2Se_3 but is always $\ll$ the theory for ionic binding. Attempts to prepare V *tellurides* by analogous methods gave impure products having $V : Te \sim 1 : 1$, resembling the selenides in appearance and properties, but having the Te rather loosely bound. The findings of Biltz and Köcher (A., 1939, I, 427) for the lower V sulphides are confirmed, apart from minor divergences in the vals. for ρ and the lattice consts. The phase relationships are analogous to those for the selenides.   F. J. G.

Preparation of pure gases and of pentane for cryostats. N. S. Rudenko (J. Phys. Chem. Russ.,

1938, **12**, 668—676).—The prep. of pure O_2 from $KMnO_4$, N_2 from NH_4NO_2, CO from $HCO_2H + H_2SO_4$, C_2H_4 from $C_2H_4Br_2 + Zn$, and of CH_4 from NaOAc and NaOH is described. C_5H_{12} can be purified by repeated freezing out.   J. J. B.

Reactions between solids. II. F. Taradoire (Bull. Soc. chim., 1939, [v], **6**, 1249—1252 ; cf. A., 1939, I, 381).—Attempts to inhibit the reactions between S and Ag, I and Hg, and S and Hg by the removal of H_2O have been unsuccessful (cf. A., 1931, 692).   J. W. S.

Action of sulphuryl chloride on metals. V. K. Perschke and C. L. Tzeitlin (J. Appl. Chem. Russ., 1939, **12**, 182—187).—Anhyd. SO_2Cl_2 strongly corrodes Cu and brass, and slightly corrodes Cr steel, Fe, cast Fe, Pb, Zn, and Al- and Ni-bronze ; it has no action on Al, Mg, and Ni. In presence of H_2O Pb is only slightly corroded by SO_2Cl_2, and Zn, Al, and Fe alloys considerably so.   R. T.

Hydrates of neutral sodium tellurate. F. Fouasson (Compt. rend., 1939, **208**, 2077—2080 ; cf. A., 1918, ii, 194).—Conductometric titration of telluric acid with NaOH and analysis of the pptd. tellurates shows that the initial pptd. product is $Na_2TeO_4,4H_2O$ (I), which is stable in presence of acid, but is converted into $Na_2H_4TeO_6$ by excess of NaOH. (I) is a metatellurate, metatelluric acid being unstable in alkaline solution (cf. A., 1936, 810).   A. J. E. W.

Potentiometric control of conversion of chromates into dichromates. L. E. Sabinina and A. K. Moralev (J. Appl. Chem. Russ., 1939, **12**, 301—308).—The p_H of 0·07M-$K_2Cr_2O_7$ is 4·18 (glass electrode). Conversion of K_2CrO_4 into $K_2Cr_2O_7$ (by addition of H_2SO_4) has been followed potentiometrically (indicator electrode Pb–PbO_2 in aq. $K_2Cr_2O_7$ at p_H 4·18, against a similar electrode in the test solution).   R. T.

Production of molybdenum. R. Lautié (Bull. Soc. chim., 1939, [v], **6**, 1236—1238).—MoO_3 is heated with H_2S or S to yield MoS_2, which is mixed with Ca and heated slowly in a vac. or in an inert atm. until reaction occurs. After cooling, the product is washed with EtOH and with H_2O (acidified if necessary with HCl) to remove CaS and the excess of Ca. The fine insol. residue contains $>99·6\%$ of Mo. The same method can be used for the prep. of pure Cr, W, and V.   J. W. S.

Ammonio-mannito-dimolybdic complexes. Determination of the constitution of the complex ion by conductometric titration. (Mme.) Z. Soubarew-Châtelain (Compt. rend., 1939, **208**, 1652—1654).—The complex formed from equimol. proportions of $NH_4HMo_2O_7$ and mannitol (I) in aq. solution has the constitution $H[HMo_2O_7,NH_3,(I)]$ (II), and gives the same X-ray diagram as Tanret's salt (A., 1921, i, 544). Conductometric titration shows that addition of 1 mol. of NaOH to (II) gives the strongly-hydrolysed Na salt, which is slowly decomposed by further quantities of NaOH into (I), Na_2MoO_4, and $NaNH_4MoO_4$; the latter gives Na_2MoO_4 and NH_3 with excess of NaOH. Neutralis-

ation of (II) with aq. NH_3 yields the NH_4 salt, which undergoes similar changes on addition of NaOH.

A. J. E. W.

Preparation and identification of three alkali molybdotellurates. S. R. WOOD and A. CARLSON (J. Amer. Chem. Soc., 1939, **61**, 1810—1812).—The crystals obtained by evaporating a solution containing 0·06M-MOH (M = Na, Rb, Cs), 0·01M-telluric acid, and 0·06M-MoO₃ are colourless, hexagonal rhombohedra and are highly efflorescent. They correspond with the general formula $3MO_2,TeO_3,6MoO_3,nH_2O$ (n for Cs = 7, for Rb = 6, for Na = 22). W. R. A.

Xanthates of metals of group VI.—See A., 1939, II, 404.

Precipitation and other reactions in liquid hydrogen fluoride. H. FREDENHAGEN (Z. anorg. Chem., 1939, **242**, 23—32; cf. A., 1930, 421).—Certain anions besides F' can exist in liquid HF, and pptn. reactions can therefore be observed. HCl, HBr, and HI have only a very slight solubility in liquid HF, but the presence of a low concn. of their ions can be shown by bubbling them through liquid HF containing Ag·, when Ag halide is slowly pptd. By treatment of chlorides at −10° with liquid HF, supersaturated solutions of HCl are obtained; these persist for some time, and give instantaneous pptn. with Ag·. Alkali and alkaline-earth perchlorates are sol. in HF, and from the solutions $AgTlO_4$ and $TlClO_4$ can be pptd. Vals. of Λ and of the b.p. elevation for solutions of $KClO_4$ in HF are in accordance with simple ionic dissociation. The solubility is 9·6 g. per 100 g. of solution. Solutions of H_2SO_4 or Na_2SO_4 in liquid HF contain a small equilibrium concn. of SO_4'', and excess of Ag· ppts. Ag_2SO_4. Chlorates, bromates, iodates, permanganates, chromates, BaO_2, nitrites, and carbonates are all decomposed by liquid HF; persulphates dissolve quietly, but addition of $TlNO_3$ or KNO_3 causes decomp. with evolution of O_2, whilst with $AgNO_3$ a ppt. of Ag_2SO_4 is also formed.

F. J. G.

Action of fuming nitric acid on iodine. R. K. BAHL and S. SINGH (J. Indian Chem. Soc., 1939, **16**, 247—248).—When fuming HNO_3 reacts with I, I_2O_4 is first formed and is converted into I_2O_5 by H_2O. In the complete absence of H_2O, I_2O_4 is obtained by removal of N oxides from the pptd. I_2O_5.

W. R. A.

Molecular compound of ferric chloride extracted by ether from hydrochloric acid solution. S. KATO and R. ISHII (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 82—96).—$FeCl_3$ can be extracted by Et_2O from a solution in 7N-HCl but not from solutions in 4N- and 10N-HCl. Absorption spectra of the Et_2O solution and of HCl solutions of various N. between 1 and 12 have been investigated. In 12N-HCl the spectrum of $FeCl_3$ is very similar to that in Et_2O. Spectroscopic evidence indicates that a mol. compound, $FeCl_3,HCl,3H_2O$, is present in the Et_2O solution. By chemical methods, gradual decrease in wt. of Et_2O extract by slow evaporation, and investigation of the composition of residual solutions at various stages of evaporation, the formula, $2FeCl_3,2HCl,9H_2O,15Et_2O$, is derived for the compound. W. R. A.

cis-trans-Isomerism in octahedral groups. H. M. POWELL (J.C.S., 1939, 1106—1108).—Theoretical. The proportion in which cis- and trans-isomeric groups of formulæ MA_2B_4, MA_3B_3, and MA_4B_2 may, with certain restrictions as to the nature of A and B, be expected to form in the same reaction from MA_6, MA_5B, cis- and trans-MA_4B_2, and cis- and trans-MA_3B_3 are discussed on a geometrical basis. Data for alkylated ferro- and cobalti-cyanides are in general agreement with the hypothesis.

C. R. H.

Quantitative spectrochemical analysis of mixtures of gases. R. A. WOLFE and O. S. DUFFENDACK (Proc. Sixth Conf. Spectros., 1938, 66—70).—Difficulties encountered in the quant. spectrochemical analysis of mixtures of gases, and methods of overcoming them, are discussed. The effect of clean-up of gases in discharge tubes is described. It varies with the type of discharge and the electrode voltage. The best type of discharge is a glow or electrodeless discharge. Intensities of lines of some elements vary with the amounts of other gases present. This difficulty is particularly marked where an inert gas is present. Interferences of this type can be overcome by using He in excess as the carrier of the discharge, and by the use of a small addition of A as the internal control. The technique of the method, which has been used to determine H_2, O_2, N_2, CO, and CO_2, is described. A. J. M.

Influence of impurities on line strength in quantitative analysis. W. R. BRODE and R. W. SILVERTHORN (Proc. Sixth Conf. Spectros., 1938, 60—65).—A review of the literature concerning the effect of impurities on line intensities shows considerable discrepancies in the magnitude of the effect. The line intensities in the case of mixtures of Cd and Zn were determined, using the homologous pairs of 3252·5 A. (Cd) and 3345·0 A. (Zn), with Na, K, Pb, Mg, Cu, and Bi as impurities. In the concn. used only Cu and Bi had an appreciable effect on the relative intensity of the Cd–Zn lines, their effects being in opposite directions. The effect of impurities on line intensities seems to be limited to certain concn. ranges, and may be either positive or negative. For complete quant. analysis working curves should be prepared with various quantities of the impurities.

A. J. M.

Applications of the spectrograph to criminal investigation. C. W. RANKIN (Proc. Sixth Conf. Spectros., 1938, 6—9).—Examples of the use of the spectrograph in criminal investigation are given, and experiments to determine the elements present on cloth through which a bullet has been fired, and the variation of their line density with distance, are described. Although it is possible to trace the elements present in the bullet and powder, it is not possible to deduce from the spectrogram the distance from which the shot was fired. The use of the spectrograph in the detection of sulphhæmoglobinæmia is also described. A. J. M.

Spectrograph as an aid in criminal investigation. J. T. WALKER (Proc. Sixth Conf. Spectros., 1938, 1—5).—Examples of the use of the spectrograph in criminal investigation are given. In particu-

lar its use in the identification of paints and poisons is dealt with, and experiments on the spectrographic identification of elements in bullet-holes in cloth are described. A. J. M.

Identifying minerals with the aid of the spectrograph. G. I. LEE and T. A. WRIGHT (Proc. Sixth Conf. Spectros., 1938, 38—45).—Putnam's chart of minerals is discussed, and a modification of it embodying results of spectrographic observations is put forward. The purity of minerals is discussed, and the use of the spectrograph in determinative mineralogy is described. The use of the instrument in the discovery of new sources of minerals is also considered. A. J. M.

Analysis of materials by fluorescent methods. W. E. ALBERTSON (Proc. Sixth Conf. Spectros., 1938, 48—50).—Examples of the application of fluorescence analysis are given. A. J. M.

p-Nitrophenylacetonitrile as an indicator. L. SPITZER (Annali Chim. Appl., 1939, 29, 219—220).— In dil. aq. solution, a yellow to orange-red colour change occurs at p_H 11·4—12·9. F. O. H.

Report of the American Oil Chemists' Society Committee on Indicators (Oil & Soap, 1939, 16, 132; cf. A., 1939, I, 533).—A 0·025% solution (0·1% for very dark oils) of Grubler's alcohol-sol. aniline-blue (cf. A., 1938, I, 533) in $Pr^\beta OH$ is recommended as an alternative indicator solution for the determination of free fatty acid in all crude cottonseed oils, the addition of 10 c.c. of light petroleum to the oil sample as and where stipulated in the standard methods being retained. The indicator solution requires very little base for neutralisation, is very little affected by atm. CO_2, and gives a clear, sharp end-point. $Pr^\beta OH$ does not appear to hydrolyse highly acid oils and is recommended as a substitute for the "Formula-30" alcohol specified in the standard methods. E. L.

Control of p_H in peroxide solutions. J. S. REICHERT and H. G. HULL (Ind. Eng. Chem. [Anal.], 1939, 11, 311—314).—The glass electrode is suitable for the determination of the p_H of peroxide solutions, but corrections are necessary in solutions of high p_H and high [Na']. A comparison of colorimetric and potentiometric p_H methods for H_2O_2 solutions of 0—200 "vols." is given. Data showing the relationship between p_H and normality for these solutions are also recorded. In H_2O_2 solutions containing H_2SO_4 the H' activity increases with the [H_2O_2].
L. S. T.

Volumetric microchemistry. I. Neutralisations and acidimetry. O. ISHIZAKA (J. Pharm. Soc. Japan., 1939, 59, 16—17).—A mathematical treatment of the errors involved by the direct use of the factors of solutions of alkali hydroxide. H. W.

Determination of hydrogen in gases.—See B., 1939, 797.

Determination of hydrogen peroxide and persulphate in the same solution. J. H. VAN DER MEULEN (Rec. trav. chim., 1939, 58, 553—558).— The S_2O_8'' is determined by means of $FeSO_4$ and $KMnO_4$ after destruction of the H_2O_2 with a trace of

OsO_4, and the total concn. of oxidising agents determined in another portion. F. J. G.

Colour tests for chlorine, ozone, and hypochlorites with methane base. A. T. MASTERMAN (Analyst, 1939, 64, 492—499).—Addition of O_3 to aq. "methane base" [$CH_2(C_6H_4\cdot NMe_2-p)_2$] (I) gives a sequence of characteristic colours : violet, amethyst, rose, and ruby-red; that of Cl_2 : blue, grass-green, olive-green, orange, and yellow with final complete bleaching. Aq. OCl' gives the Cl_2 sequence. By concentrating (I) in EtOH solution, however, the O_3 sequence may be obtained. Hypochlorites prepared electrolytically give reactions which suggest that O_3 is also present. E. C. S.

Volumetric oxidation of iodide to iodate by sodium chlorite. L. F. YNTEMA and T. FLEMING (Ind. Eng. Chem. [Anal.], 1939, 11, 375—377).— Aq. $NaClO_2$ can be used for the volumetric determination of I' in solutions buffered to p_H 5·3—5·7 with acetates or phosphates, but less satisfactorily so with Zn salts. The reaction involved is $3HClO_2 + 2I' = 2IO_3' + 3Cl' + 3H'$. NO_3' and SO_4'' do not interfere, but Cl' retards the reaction and Br' must be absent. 0·04—0·07 g. of iodide is dissolved in cold air-free H_2O. 1 ml. of 2M-AcOH, 9 ml. of 2M-NaOAc, and starch solution are added, and the whole is titrated with 0·1— 0·2N-NaClO_2 until discharge of the blue colour indicates conversion of I' into IO_3'. A slight excess of chlorite is added and back-titrated with 0·02M-KI to a permanent amber colour. L. S. T.

Colorimetric determination of fluorine with ferron. J. J. FAHEY (Ind. Eng. Chem. [Anal.], 1939, 11, 362—363).—The yellowish hue produced by the action of F' in the unknown solution on the green colour of the ferron–Fe reagent (0·1N-FeCl_3 in 2N-HCl + aq. 7-iodo-8-hydroxyquinoline-5-sulphonic acid) is matched in a comparison solution by addition of a standard solution of NaF. Details for the determination of F in rocks, which are fused with Na_2CO_3 and treated with $ZnCl_2$ and $ZnO + (NH_4)_2CO_3 +$ aq. NH_3, are given, and test data on synthetic samples are recorded. A difference in colour corresponding with a difference in [F'] of 0·05 mg. is detectable with rocks, and one of 0·025 mg. with natural waters. The method is applicable to rocks and minerals containing ≯10% of F, and to waters containing ≮1 p.p.m. Results obtained on waters by this method are compared with those given by the ferrithiocyanate method (A., 1933, 41, 921). L. S. T.

Determination of dissolved oxygen in aqueous solutions.—See B., 1939, 788.

Determination of organic sulphur in gas mixtures.—See B., 1939, 797.

Potentiometric determination of selenious acid with silver ion. R. RIPAN-TILICI (Z. anal. Chem., 1939, 116, 431—433).—The solution containing SeO_3'' is neutralised (p_H 8—9) with 0·05M-NaHCO_3 and titrated potentiometrically with 0·1 or 0·05M-AgNO_3, with vigorous stirring. The method is preferred to that described previously (A., 1939, I, 96). Data for the titration of 0·001—0·0025M-Na_2SeO_3 are recorded. L. S. T.

Selenium catalyst in the Kjeldahl digestion of leather.—See B., 1939, 867.

Rapid method of determining [protein-]nitrogen.—See B., 1939, 877.

Determination of nitrogen oxides in [coal] gas.—See B., 1939, 797.

Spectrographic determination of arsenic in copper.—See B., 1939, 840.

Colorimetric micro-determination of boron. J. A. NAFTEL (Ind. Eng. Chem. [Anal.], 1939, 11, 407—409).—An aliquot portion of soil or plant ash extract containing 0·5—8·0 μg. of B is made alkaline with 0·1N-Ca(OH)$_2$, evaporated to dryness, and then cooled to room temp. A solution of H$_2$C$_2$O$_4$ + HCl is added, followed by either curcumin or turmeric in 95% EtOH. The mixture is evaporated to dryness at 55±3° and heated at this temp. for 30 min., in order to complete the colour reaction between the H$_3$BO$_3$ and curcumin or turmeric. The residue is extracted with 95% EtOH, filtered or centrifuged, and compared with standard solutions treated similarly. Interference from other ions normally present in soil extracts is negligible. The comparison is best effected in a photo-electric colorimeter. Kavalier Bohemian glass is a satisfactory B-free glass. Test data showing the effects of variations in conditions on the intensity of the developed colour are recorded.
                                                L. S. T.

Photometric method for the determination of carbon dioxide. R. J. WINZLER and J. P. BAUMBERGER (Ind. Eng. Chem. [Anal.], 1939, 11, 371—375).—[CO$_2$] is measured continuously by determining the changes in light transmission of a solution of Me-red through which the gas is passed. A method of making gas mixtures of known composition is described. A method of calculating the reliability of photometric measurements is developed and applied to the case of CO$_2$.   L. S. T.

Warder's method for the titration of carbonates. A. A. BENEDETTI-PICHLER, M. CEFOLA, and B. WALDMAN (Ind. Eng. Chem. [Anal.], 1939, 11, 327—332).—A crit. survey of the method shows that titration of CO$_3$'' to HCO$_3$' must be carried out in a closed system to avoid loss or gain of CO$_2$. A procedure of suitable accuracy has been tested on a CO$_3$''–HCO$_3$' solution. In the application of Warder's method to the determination of OH', CO$_3$'', and HCO$_3$' in presence of each other the precision becomes poor when the mass of the constituent determined is <0·1 of the mass of the major component. The method is inapplicable to the determination of traces of hydroxide in carbonate, of traces of carbonate in H carbonate, and vice versa.   L. S. T.

Gas-volume determination of carbonate in calcareous materials.—See B., 1939, 823.

[Alkalis in] silicate analysis. BÜTTNER (Keram. Runds., 1939, 47, 101—102).—The Lawrence Smith method and its modifications (e.g., use of CaCl$_2$ in place of NH$_4$Cl) are excellent when correctly carried out, but care must be taken to avoid volatilising the alkali chlorides by overheating. Use of Ba compounds in place of Ca did not lower the reaction temp.

sufficiently to overcome this. If the material is too coarse or is insufficiently strongly heated, attack is incomplete. This method is preferable in the presence of MgO, B$_2$O$_3$, and P$_2$O$_5$, but otherwise the Berzelius (HF) method is safer and quicker.   G. H. C.

Use of flame in spectrum analysis. S. L. MANDELSTAM (Compt. rend. Acad. Sci. U.R.S.S., 1939, 22, 403—406).—Calculations of the effect of relatively large amounts of Na salts and KCl on the intensity of the Rb lines given by 0·001% aq. RbCl (A., 1939, I, 227) are recorded and discussed.
                                                L. S. T.

Identification of silver. F. A. VAN ATTA (J. Chem. Educ., 1939, 16, 164).—Reduction to Ag of the ammoniacal solution of AgCl by means of CH$_2$O in presence of KOH is preferred to acidification by HNO$_3$ in which re-pptn. of AgCl is erratic. In the absence of large amounts of Hg·, Ag· can be detected at a concn. of 0·5 mg. per l.   L. S. T.

Qualitative mineral analysis. G. EMSCHWILLER and G. CHARLOT (Ann. Chim. Analyt., 1939, [iii], 21, 176—180).—A method of qual. analysis which combines the classical method of separating metals into groups with sp. tests, particularly with org. reagents, is suggested.   J. W. S.

Quantitative precipitations at extreme concentrations. VI. V. NJEGOVAN and V. MARJANOVIĆ (Z. anal. Chem., 1939, 117, 109—118; cf. A., 1937, I, 147; 1933, 921).—Numerous data showing the purity of the BaSO$_4$ pptd. by the method described previously (A., 1928, 497) under different conditions are recorded. The BaSO$_4$ contains ≯1% BaCl$_2$ and, when pptd. in presence of Fe···, ≯ traces of Fe$_2$O$_3$. The method is also applicable in presence of NH$_4$ salts. Filtration is improved by the use of paper pulp. The results also refute the criticisms of Balarev (A., 1939, I, 72).   L. S. T.

Reaction of zinc with copper sulphate in aqueous solution. F. W. VAN STRATEN and W. F. EHRET (J. Amer. Chem. Soc., 1939, 61, 1798—1804). Zn strips, 0·3 mm. thick, were annealed at 200°, coated on one side with varnish, and etched. Four strips were suspended in 1 l. of CuSO$_4$ solution, thermostatically controlled, on a glass cage attached to the rotor of the stirring apparatus and the effective area of exposed surface was 12 sq. cm. per strip. The deposits formed under a variety of experimental conditions were examined by chemical and X-ray methods. Increased [CuSO$_4$] gave a Cu-enriched deposit whilst addition of ZnSO$_4$ to the CuSO$_4$ solution diminished the amount of Cu in the deposit. The greater is the speed of stirring, the greater is the amount of Cu deposited, indicating that rates of displacement are governed by diffusion. Variation in p_H has a negligible effect. Secondary reactions between the deposit and CuSO$_4$ solution have been investigated. X-Ray evidence indicates that Cu is the principal phase at 25° with some α-brass. At higher temp. and at low [CuSO$_4$] the amounts of α- and β-brass increase.
                                                W. R. A.

Determination of zinc as zinc mercury thiocyanate. I. SARUDI (v. STETINA) (Österr. Chem.-Ztg., 1939, 42, 297—298).—50 c.c. of solution con-

taining ~ 0.1 g. of Zn are acidified with 1—2 c.c. of N-HNO_3 and 40 c.c. of reagent (27 g. of $HgCl_2$ and 39 g. of KCNS per l.) added with continual stirring. After 30 min., the $ZnHg(CNS)_4$ is collected (Jena 1G4), washed with H_2O, EtOH, and finally anhyd. Et_2O, and dried for 90 min. at 100°. Small amounts of Zn (0·01—0·005 g.) can be determined by using reduced vols. The method tends to give results which are slightly low, but can be improved by adding to the solution one third of its vol. of 96% EtOH after pptn. has been effected and washing with dil. (1 : 2) EtOH instead of H_2O. Test data are recorded. L. S. T.

Determination of cadmium in silicate rocks. E. B. SANDELL (Ind. Eng. Chem. [Anal.], 1939, 11, 364—365).—The rock powder is attacked by means of $HClO_4$ + HF, and the heavy metals are extracted by shaking the ammoniacal citrate solution of the decomposed rock with dithizone (I) in CCl_4. The CCl_4 phase is separated and shaken with 0·01N-HCl, when the Zn, Pb, and Cd dithizonates are decomposed and the metals go into the aq. phase as chlorides. Cd is then determined in 5% NaOH solution by means of (I) in CCl_4 (A., 1937, I, 632). Details of procedure and test data are given. With a 0·5-g. sample, 0·02—0·03 µg. of Cd can be detected. Results tend to be low. Cu, Zn, Pb, and Co in the amounts likely to occur in igneous rocks do not interfere, but large amounts of Ni render the method inapplicable. Mn tends to prevent complete extraction of Cd, but this can be overcome by adding NH_2OH,HCl. L. S. T.

Determination of lead by dithizone. Modifications and improvements of the Hubbard–Clifford–Wichmann method as applied to biological material. K. BAMBACH (Ind. Eng. Chem. [Anal.], 1939, 11, 400—403; cf. A., 1936, 443).— Slight changes in apparatus and in manipulation of Hubbard's method (A., 1937, III, 504) result in a saving of time and an increased recovery of Pb. The use of NH_2OH in the initial extraction prevents oxidation of the dithizone (I), and eliminates the necessity of the second extraction step of the Hubbard method. Washing the first $CHCl_3$ extract removes extraneous entrained salts, and improves the test for Bi. Elimination of filtrations through cotton and paper, and addition of the standard (I) and the development of the mixed colour in all samples of a series before the photometric readings are made, save time without loss of accuracy. Details of procedure and a comparison of results obtained by the old and the new methods are given. Methods for the prep. of Pb-free solutions of NH_4 citrate, KCN, and NH_2OH,HCl are described. By purification of reagents and elimination of contamination the " blank " has been reduced to 0·1 µg. L. S. T.

Determination of lead in steels.—See B., 1939, 838.

Electro-analytical determination of copper and lead in nitric acid solution containing small amounts of hydrochloric acid. J. A. SCHERRER, R. K. BELL, and W. D. MOGERMAN (J. Res. Nat. Bur. Stand., 1939, 22, 697—700).—Complete cathodic deposition of Cu from HNO_3 solution is obtained if a trace of Cl′ is added either during dissolution of the alloy or before electrolysis. The sample (1 g.) is treated with 50% HNO_3 (25 c.c.) and 0·1N-HCl (1 drop). When action has ceased the solution is boiled until all N oxides are expelled and is then diluted to ~ 150 c.c. If Sn is present the solution is digested for < 1 hr. and the ppt. is separated and washed with hot dil. HNO_3. The filtrate is neutralised with aq. NH_3, 6 c.c. of HNO_3 are added, and the solution is diluted to 200 c.c. Cu and Pb are deposited on cylindrical Pt gauze electrodes with a current of 0·2—0·4 amp. J. W. S.

Rapid electro-analysis of copper. M. GELOSO (Bull. Soc. chim., 1939, [v], 6, 1238—1243).—The action of Fe^{III} in causing redissolution of Cu deposited electrolytically (A., 1939, I, 424) can be prevented by addition of a fluoride, which converts it into $[FeF_6]'''$. For determination of Cu in the presence of Fe the sample, containing > 0.5 g. of Fe, is dissolved in conc. H_2SO_4 (5—10 c.c.) and HNO_3 (d 1·33, 2—3 c.c.). The solution is diluted to 200 c.c., 25 g. of NH_4OAc are added, and 10% aq. KF or saturated aq. NaF is run in until only the colour due to Cu remains. The solution is then electrolysed at 60—80° with agitation for $\frac{1}{2}$ hr., using a current > 1 amp. J. W. S.

Determination of copper by Schachkeldjan's method with the help of Lange's photo-electric colorimeter. W. MAIER (Z. anal. Chem., 1939, 116, 410—421).—Sources of error in this determination by Schachkeldjan's method (A., 1930, 444) have been investigated. The colour intensity and colour tone change quickly after addition of the KCN, but the time interval between the addition of the benzidine and the KCN is without effect on the extinction. The age of the Na salicylate solution also affects the colour in certain cases, but not invariably. The [KCN] of solutions for comparison must be the same. In the procedure described, the extinction must be determined immediately after the addition of the KCN. The method gives an accuracy of 0·2—0·3% with 0·002 —10 mg. of Cu in 20 c.c. of solution. L. S. T.

Simple micro-test for copper. E. HEYMAN and L. F. KERLEY (Analyst, 1939, 64, 502—503).— 0·5—1 p.p.m. of Cu can be detected by the formation of a blue-green colour when 100 c.c. of the solution are treated with a drop (0·05 ml.) of oleic acid. The p_H should be between 5 and 8. Co, Ni, and Cr do not interfere, and Mn and Fe only when present in quantity. E. C. S.

Sulphamic acid in the separation of the rare earths. J. KLEINBERG, W. A. TAEBEL, and L. F. AUDRIETH (Ind. Eng. Chem. [Anal.], 1939, 11, 368— 369).—Ce-free rare earth oxides are dissolved in a slight excess of $NH_2·SO_3H$, and the cooled, filtered solution is treated with solid $NaNO_2$, which ppts. the La sub-group as sulphates. The Y sub-group is then pptd. as oxalates. The method compares favourably with the classical alkali double sulphate procedure, over which it has certain advantages. The sulphamates of La, Nd, Sm, and Y have been prepared. They are insol. in abs. EtOH, MeOH, $COMe_2$, dioxan, C_5H_5N, and liquid NH_3. They decompose slowly at 100° into the corresponding sulphates, and undergo slow hydrolysis in hot, aq. solution. L. S. T.

Acidimetric determination of aluminium. K. KOMÁREK (Coll. Czech. Chem. Comm., 1939, **11**, 189—195).—Freshly pptd. $Al(OH)_3$ is titrated with 0·1N-HCl using bromophenol-blue as indicator. The method is applicable to 0·0001—0·04 g. of Al. With the max. amount of Al allowed, the final vol. of the solution should be ~80 ml. and the titration should take ~30 min. C. R. H.

Quantitative spectral analysis of aluminium and aluminium alloys.—See B., 1939, 844.

Separation of cobalt from manganese. J. G. FAIRCHILD (Ind. Eng. Chem. [Anal.], 1939, **11**, 326—327).—Mn can be separated almost completely from Co by pptn. as phosphate by adding aq. NH_3 slowly to a hot solution containing 2 g. of citric acid, 1—2 g. of $(NH_4)_2HPO_4$, 20 g. of NH_4Cl, and $\not>$ 0·1 g. of Mn per 100 ml. Other members of the $(NH_4)_2S$ group and $>$ a few mg. of the alkaline earths, and Mg, should be absent. The Mn is determined finally by the bismuthate method. Co retained by the Mn is determined colorimetrically as the blue $CoCl_2$. The presence of $>$1 mg. of Co imparts a lilac colour to the pptd. Mn phosphate. The main portion of Co is pptd. as sulphide at p_H 5·2 in dil. AcOH solution, converted into $CoSO_4$, and weighed as anhyd. sulphate after ignition at 550—600°. Up to 0·444 g. of $CoSO_4$ can be accurately determined as the anhyd. salt. The procedure is especially suitable for the analysis of Co-bearing psilomelane. L. S. T.

Polarographic studies with the dropping mercury electrode. X. Anodic oxidation of manganese tartrate and its analytical applications. E. T. VERDIER (Coll. Czech. Chem. Comm., 1939, **11**, 233—242).—The irreversible oxidation of Mn^{II} to Mn^{III} takes place in strongly alkaline solutions in presence of 5% of tartrate and in absence of O_2. The height of the polarographic waves varies quantitatively with the amount of Mn. Mn in Fe alloys can be determined polarographically by reducing a HCl solution of the alloy with Na_2SO_3 and adding KCN. The height of the waves due to electrodeposition of $Mn(CN)_2$ is a measure of the amount of Mn. Cr, Zn, and Cu do not interfere. In presence of Co, alkali and tartrate are added instead of KCN to the reduced alloy solution. Traces of Fe in Mn can be determined by making use of the anodic oxidation wave of Fe^{II} in alkaline tartrate solution, Mn not interfering provided it is present as Mn^{II}. C. R. H.

Standardisation of strong oxidising agents with potassium iodide by the acetone method. I. M. KOLTHOFF and H. A. LAITINEN (J. Amer. Chem. Soc., 1939, **61**, 1690—1691; cf. A., 1937, I, 260).—A simple procedure is described for the standardisation of 0·1N-$KMnO_4$ and 0·1N-$Ce(SO_4)_2$ by Berg's method using KI as the primary standard, which gives results 0·8—1% low when applied to 0·01N. solutions. The low results are due to the reduction of the oxidising agent by $COMe_2$ and $COMe·CH_2I$ near the end-point. W. R. A.

Tetraphenylarsonium chloride as an analytical reagent. Determination of rhenium. H. H. WILLARD and G. M. SMITH (Ind. Eng. Chem. [Anal.], 1939, **11**, 305—306).—ReO_4' forms with $AsPh_4\cdot$ a white, cryst. ppt. which is insol. in H_2O. ReO_4' can thus be determined potentiometrically, gravimetrically, or by titration of the excess of the reagent with I (cf. A., 1939, I, 336). In the gravimetric method, 0·40—133·0 mg. of ReO_4' in a vol. of 25—60 ml. can be satisfactorily determined by addition of a measured excess of $AsPh_4Cl$ to the hot solution in presence of NaCl (0·5M.) which facilitates the production of a cryst. ppt. that can be easily handled. Pptn. can be effected in weakly alkaline to acid solutions. NaOH exerts a solvent effect on the ppt., but relatively high $[NH_3]$ is not harmful. NO_3' in all but low concn. must be absent. MnO_4', ClO_4', IO_4', I', Br', F', CNS', $Hg^{..}$, $Sn^{....}$, $VO_2^{....}$, and $Bi^{...}$ interfere. Interference by MoO_4'' can be avoided by the use of aq. NH_3, citrate, or tartrate. L. S. T.

Effect of foreign ions on double mercuric thiocyanate reactions. (Interference in microchemical reactions.) F. M. BOSCH (Natuurwetensch. Tijds., 1939, **21**, 117—121).—Fe^{III} gives a ppt. similar to that given by Cu, when treated with $Zn^{..}$ and $NH_4Hg(CNS)_4$. The Fe can be kept in solution by using 0·1N-NaF solution, which retains 1·22 mg. Fe per c.c. $Fe(CNS)_3$ can also be removed by extraction with Et_2O. Na tartrate, Na citrate, and $K_2C_2O_4$ do not prevent pptn. of Fe. S. C.

Determination of iron in tungsten and tungstic acid.—See B., 1939, 842.

Determination of cobalt in steels.—See B. 1939, 838.

Determination of nickel and cobalt in silicate rocks. E. B. SANDELL and R. W. PERLICH (Ind. Eng. Chem. [Anal.], 1939, **11**, 309—311).—The method is based on the extraction of Ni dimethylglyoxime (I) with $CHCl_3$ from an ammoniacal citrate solution obtained after the rock sample (0·25—0·5 g.) has been attacked by means of $HClO_4$ and HF. By shaking the $CHCl_3$ extract with dil. HCl, (I) is decomposed, and the Ni is brought into the aq. phase, in which it is determined colorimetrically by Rollet's method (A., 1926, 930). The method will detect $<$0·0001% of Ni in 0·5 g. of rock, and is designed for rocks in which the Ni content is too low to be determined gravimetrically (A., 1934, 49). Cu, Co, Mn, Cr, and V in the amounts likely to be encountered in igneous rocks do not interfere. Co in rocks is determined by extraction of the heavy metal dithizonates with CCl_4 from an ammoniacal citrate solution of the sample (0·25—1 g.). The extract is evaporated to dryness, the residue ignited, and the oxides dissolved in HCl + HNO_3. Cu is reduced to $Cu^{.}$ by means of $SnCl_2$, and the Co determined colorimetrically by addition of NH_4CNS and $COMe_2$. Some Ni accompanies the Co, but its low concn. does not interfere even with a ratio Ni : Co of 10 : 1. The Co can also be determined by the NH_4CNS-$C_5H_{11}·OH$ method in which large amounts of Ni do not interfere. With a 1-g. sample, 0·0001% can be detected. L. S. T.

Colorimetric determination of nickel as nickel–ammonia complex ion. G. H. AYRES and F. SMITH (Ind. Eng. Chem. [Anal.], 1939, **11**, 365—367).—A method for the colorimetric determination of Ni as its NH_3 complex is described. The blue

colour is stable over a period of 150 hr., and develops best in 1·5N-NH_3. NH_4 salts up to 1·5 N., SO_4'', Cl', and NO_3' are without effect on the transmission. 0·5 mg. of Ni per l. can be detected, and the optimum region of sensitivity lies between 500 and 1500 mg. per l. In this range, the accuracy is 1%. Interference by Co is marked, and cannot be eliminated by the use of a light-filter. In steels, Ni is first separated as the dimethylglyoxime compound which is dissolved in HNO_3 and evaporated to a small vol. before dilution with 1·5N-NH_3. This method for Ni in steels is less accurate than the gravimetric, but is quicker.

L. S. T.

Rapid determination of chromium in leather etc.—See B., 1939, 867.

Volumetric determination of molybdenum.—See B., 1939, 843.

Analytical chemistry of tungsten. I. D. A. LAMBIE (Analyst, 1939, 64, 481—490).—The recovery of H_2WO_4 from sulphate solutions containing alkali metal sulphate by pptn. with mineral acid or cinchonine is incomplete. Schoeller and Jahn's tannin-cinchonine method (A., 1927, 1047) is rapid and accurate. A modification of the method for determining larger amounts (>0·2 g.) of H_2WO_4 is described.

E. C. S.

Precipitation of tin from alkaline solution with bromine water. T. KROKOWSKI (Z. anal. Chem., 1939, 117, 105—109).—Sn is pptd. quantitatively as α-stannic acid (I) from an alkaline solution by the addition of aq. Br, preferably at a temp. >30°. The presence of NH_4NO_3 accelerates pptn. KOH is preferable to NaOH for the original dissolution of the Sn; a large excess should be avoided. Excess of Br should be removed, if desired, adding $(CH_2)_6N_4$ and heating to 60°. Although colloidal, the ppt. is easily filtered and washed (0·1% NH_4NO_3). Tartaric and citric acids inhibit pptn.; small, but not high, concns. of C_2O_4'' are without effect. Owing to adsorption by (I), the method cannot be used for separating Sb and Sn.

L. S. T.

Volumetric determination of tin in ores.—See B., 1939, 841.

Spectrographic determination of vanadium in steel.—See B., 1939, 838.

Low-temperature precision adiabatic calorimeter adapted to condensed gases from 10° K. to room temperature. J. G. ASTON and M. L. EIDINOFF (J. Amer. Chem. Soc., 1939, 61, 1533—1538).—A low-temp. adiabatic calorimeter for condensed gases (described) has an accuracy of 0·05% in sp. heat measurements up to room temp., and 0·1% in heat of vaporisation measurements at approx. room temp. The heat capacity of liquid NH_2Me has been determined over the entire range below room temp.

W. R. A.

Reproducibility of the platinum thermocouple at the freezing points of gold, silver, and antimony. M. DE SELINCOURT (Proc. Physical Soc., 1939, 51, 695—709).—The factors limiting the reproducibility of the standard Pt couple at the three points at which it is calibrated for the realisation of the

international temp. scale for 660—1063° are considered with reference to electrical measurement, temp. conditions in the furnaces containing the ingots, and homogeneity of the thermocouple wires. The electrical measuring unit is found to be adequate for an accuracy of the order ±0·01°, and improvements in the other two factors render such an increased accuracy just attainable as an upper limit. The quality of the thermocouple wires, particularly in relation to their state of strain, is the main obstacle to an increase in reproducibility beyond the normal limit of ±0·1°.

N. M. B.

Calorimetric measurements. Combustion of solids and liquids. T. J. KALIŃSKI and C. FIJAŁKOWSKI (Przemysł Chem., 1939, 23, 147—152).—Powders are weighed and burned in collodion bags, non-volatile liquids in Pt dishes in similar bags, and volatile liquids in sealed thin glass ampoules similarly wrapped in collodion bags (the ampoules cave in at the pressure prevailing in the bomb after loading with O_2).

R. T.

Mechanical thermo-regulator. A. C. BRATTON (Science, 1939, 89, 589—590).—Three types of regulator, giving control to ±0·01°, ±0·03°, and ±0·003°, in which a controlled stream of cooling H_2O (tap H_2O) is constantly introduced into the bath, are described and illustrated.

L. S. T.

Experiments on pumping liquid helium to low temperatures. A. H. COOKE and R. A. HULL (Nature, 1939, 143, 799—800).—Using a membrane pierced by a small hole to restrict the creeping of the He II film (cf. A., 1939, I, 220) temp. of ∼0·73° K. have been obtained in a vessel of 4 c.c. capacity with an ordinary pump of 10 l. per sec. speed. L. S. T.

Cryoscopy. D. M. QUINTELA (Rev. Soc. Brasil. Quím., 1939, 8, 35—39).—A review of methods employed in the cryoscopic determination of mol. wt.

F. R. G.

Possible use of superconductivity for radiometric purposes. A. GOETZ (Physical Rev., 1939, [ii], 55, 1270—1271).—The superconductivity of metal crystals near the lower end of the temp. scale appears to fulfil the conditions of a radiometer favourably owing to the practical non-existence of thermal indeterminacy, the sharp transition, and the nearly infinite temp. coeff. A sensitivity of 10^{-11}—10^{-12} g.-cal. per sec. is calc. N. M. B.

Radiation measurements on short [hertzian] waves. C. GUTTON and F. CARBENAY (Compt. rend., 1939, 208, 1954—1957).—A hot wire and thermocouple are used to determine the induced current in a symmetrical frame, from which the intensity of the vertical component of the field is deduced. The apparatus is designed for λλ of 10—50 m. A. J. E. W.

Standard wave-lengths. W. F. MEGGERS (Proc. Sixth Conf. Spectros., 1938, 114—117).—A committee of the International Astronomical Union has made recommendations for a system of international standard λλ consisting of a primary standard (red radiation, 6438.4696 A., from Cd under certain conditions), secondary standards from the spectrum of the Fe arc, a table of which is given, tertiary or inter-

polated Fe standards, secondary standards from inert gas spectra (Ne and K, tables given), and solar spectrum standards. A. J. M.

Characteristics of spectroscopic light sources. R. A. SAWYER and H. B. VINCENT (Proc. Sixth Conf. Spectros., 1938, 54—59).—The factors demanded in a light source for accuracy in spectrographic analysis are discussed. The use of the d.c. arc and methods of stabilising it are described. The a.c. arc and spark methods are also described. The technique of the internal standard method of analysis is considered. A. J. M.

Characteristics of the Eagle mounting of the concave grating. G. H. DIEKE (Proc. Sixth Conf. Spectros., 1938, 71—79).—A comparison of the different grating mountings, including the Rowland, the Paschen, the Wadsworth, and the Eagle mounting, shows that for ordinary laboratory use the Eagle mounting is the most suitable. The astigmatism of the concave grating can be effectively removed in the Eagle mounting with the use of cylindrical lenses. A. J. M.

Improved density comparator. J. W. FORREST (Proc. Sixth Conf. Spectros., 1938, 88—90).—An apparatus designed for continuous accurate performance is described. A. J. M.

High-speed method of absorption spectrophotometry for the range 10,000 to 2000 A. G. R. HARRISON (Proc. Sixth Conf. Spectros., 1938, 91—96).—An automatic spectrophotometer consisting of the following four units is described : a concave grating monochromator which gives high intensity and spectral purity and almost const. high dispersion; photo-electric measurement of intensities by means of an electron multiplier with an amplification of 30,000,000, with sufficient output to operate a cathode-ray oscillograph through a supplementary logarithmic amplifier; a cathode-ray oscillograph and motion-picture film enabling density measurements to be made at the rate of 10 or more per sec.; an oscillating mirror to reflect a monochromatic beam through solution and blank cells up to 60 times a sec. A. J. M.

Standard helium lamp for measuring intensities of spectral lines. O. S. DUFFENDACK and R. A. WOLFE (Proc. Sixth Conf. Spectros., 1938, 97—100).—A simple lamp containing He, of which the spectrum lines would have const. relative intensities over a long period, is described. The advantages of using a standard lamp are discussed. Variation of the voltage applied to the lamp did not alter the relative intensities of the lines emitted. A. J. M.

Application of isodensity contouring methods to spectrum photometry. B. O'BRIEN (Proc. Sixth Conf. Spectros., 1938, 101—109).—The application of the wedge method of determining intensity of spectrum lines is considered, particularly as regards its accuracy. The precision of the method with high-contrast printing is equiv. to that of the more common method of measuring the density and calculating intensity from the characteristic curve, and it has the advantages of speed and convenience. The applica-

tion of the method to the automatic determination of O_3 in the zenith atm. is described. A. J. M.

Testing dispersion filters. F. WEIGERT (Proc. Sixth Conf. Spectros., 1938, 110—111).—The use of dispersion filters (mixtures of a suitable coarse-grain powder, e.g., glass, and an org. liquid) as mono-chromators is described, and their advantages are discussed. A simple method of calibrating such filters is described. A. J. M.

Standard slide for qualitative spectrochemical analysis. T. C. CHANG (J. Shanghai Sci. Inst., 1939, [i], **1**, 225—238).—A standard slide for qual. spectro-graphic analysis by the arc method has been prepared. The slide contains the persistent lines of all the elements which can be detected by the arc process. A. J. M.

Diffraction of X-rays by a crystalline powder sprinkled on an immobile plane surface. F. D. LA TOUR (Compt. rend., 1939, **209**, 51—53).—A new method of X-ray diffraction by powders is described and its advantages and disadvantages are discussed. The theory of the method is outlined. W. R. A.

Photo-electric photometer for colorimetric chemical analysis. M. ROSENFELD (J. Biol. Chem., 1939, **129**, 179—187).—An improved lay-out, applicable over a wide range of concns., is described. R. S. C.

Application of fine-grain processing and condenser illumination enlarging to photomicrography. F. P. McWHORTER (Stain. Tech., 1939, **14**, 87—96).—Photomicrographs involving great resolution can be satisfactorily made by using an intermediate projection distance of about 160 mm. and recording the negative image in very fine grain. This eliminates vibration difficulties attending long exposure, and crit. enlarging at magnifications above ×2000 gives consistently good results. E. E. H.

Technique in X-ray analysis of clays. J. C. L. FAVEJEE (Z. Krist., 1939, **100**, 425—436).—Difficulties peculiar to analysis of the fine-grained (<2 μ.) clay fractions are reviewed, and standard experimental and analytical methods detailed. Performance of a H_2-atm. powder camera is illustrated by X-radiograms. Relative intensities of lines obtained for α-quartz, muscovite (Ural), kaolinite (S. Carolina), and montmorillonite (Algeria : dried at 75% R.H.) are used in an approx. determination of their content in sea and river silts, loam, and fuller's earth. I. McA.

Laue patterns by reflected X-rays. D. E. THOMAS (J. Sci. Instr., 1939, **16**, 222—228).—The X-rays are reflected from the surface of a metal ingot on to a film placed in a conical camera. A specially constructed circular slide rule is used in working out the crystal orientation. D. F. R.

Ultramicroscope with large frontal distance for the study of aërosols. P. TAUZIN (Compt. rend., 1939, **209**, 27—30).—An ultramicroscope is described which can be modified to observe the motion of particles in the centre of an aërosol contained in cubic chambers of 4 cm. or 10 cm. side. The apparatus has been adapted to the measurement of the speed of

fall of the particles, the coagulation of aërosols, and the relation between the light diffused by the particles and their diameter, and the no. of particles per c.c.   W. R. A.

Antimony electrode for industrial hydrogen-ion measurements. G. A. PERLEY (Ind. Eng. Chem. [Anal.], 1939, **11**, 316—318).—The requirements of an industrial p_H electrode, the variable factors of a metal–metal oxide electrode, and the choice of such an electrode are discussed. The behaviour of Sb electrodes prepared in different ways from solid metal or from electroplated Sb on Pt or Au wires is described. A satisfactory form has been obtained by casting the electrolytically-deposited metal into a cylinder around which rubber is moulded. The exposed bottom of metal is ground and polished to a uniform smooth surface. Secondary reactions where the metal enters the solution are eliminated. Continuous measurements with an unprotected stick of Sb give erroneous results.   L. S. T.

Characteristics of the antimony electrode. G. A. PERLEY (Ind. Eng. Chem. [Anal.], 1939, **11**, 319—322).—The Sb electrode used is of the type described previously (cf. preceding abstract). The effects of the nature of the electrode surface, the concn. of dissolved air or O_2, agitation at the electrode surface, the nature and concn. of dissolved salts, and temp. on the e.m.f.–p_H relationships of the electrode are detailed. With correct standardisation of these variables, continuous p_H measurements, reproducible to ± 0.15 p_H, can be obtained. The electrode gives satisfactory industrial performance in sugar- and paper-mill solutions, silicate solutions and clay suspensions, PO_4, aq. NH_3, and alum solutions, beer, lime treatment, etc.   L. S. T.

Determination of electrometric equivalence points. J. R. GAY (Ind. Eng. Chem. [Anal.], 1939, **11**, 383—386).—The apparatus described is simpler and less costly than that of the usual methods of potentiometric titration, and is equally sensitive. Its behaviour in the titration of $K_2Cr_2O_7$ with $FeSO_4$, of $FeSO_4$ with $KMnO_4$ or $Ce(SO_4)_4$, and of V^{IV} with $KMnO_4$ is described. The method is particularly serviceable in the determination of org. matter in sedimentary rocks by oxidation with H_2CrO_4 and back titration with Fe^{II}, where the use of $NHPh_2$ presents serious difficulties.   L. S. T.

Production of neutrons. C. WEISS and H. WESTMEYER (Physikal. Z., 1939, **40**, 461—466).—A simple apparatus for the production of neutrons making use of the reaction $^2_1D + ^2_1D \rightarrow ^3_2He + ^1_0n$ is described. It involves the use of a source of ions of high and const. intensity (described), and provides neutrons equiv. to 1 g. of Rn + Be.   A. J. M.

" Shadow "-microscope, a new electron-microscope. H. BOERSCH (Naturwiss., 1939, **27**, 418).—A new electron microscope, in which the image is the shadow of the object, is described. There is no optical system between the object and the screen.   A. J. M.

Performance of the electron shadow microscope, and an X-ray shadow microscope. M.

VON ARDENNE (Naturwiss., 1939, **27**, 485—486).—Under the same conditions the electron shadow microscope is as effective as the ordinary electron microscope as regards resolving power and intensity of image. An X-ray shadow microscope is described. Where refraction is necessary electron beams are used, but where rectilinear propagation is required X-rays are used. The resolving power of such an arrangement is independent of the thickness of the object.   A. J. M.

Electron tube direct-current voltmeter. R. L. GARMAN and M. E. DROZ (Ind. Eng. Chem. [Anal.], 1939, **11**, 398—399).—The use of 1·5-v. tubes with very low filament current permits the construction of an improved battery-operated voltmeter. Greater stability is obtained and operation is simplified by using a circuit which is new in principle. Operation as a titrimeter is also described.   L. S. T.

Cathode-ray tube alternating-current bridge detector for conductivity measurements. F. HOVORKA and E. E. MENDENHALL (J. Chem. Educ., 1939, **16**, 239—241).   L. S. T.

Method of comparing capacities at radio frequencies [and of determining dielectric constants]. W. VAUGHAN (Phil. Mag., 1938, [vii], **26**, 521—557).—The method described may be used to measure ϵ.

Determination of dipole moments in the vapour phase. I. An improved apparatus. L. G. GROVES (J.C.S., 1939, 1144—1147).—A heterodyne apparatus which employs stabilised matched oscillators of the Hartley type coupled electronically is described. The complete apparatus has a frequency variation of only about 3 cycles over periods of several hr., the natural frequencies of the oscillators being about 10^6 cycles. The gas cell is vapour-jacketed and the changes in capacity due to the introduction of dielectric gases or vapours are measured by direct parallel replacement on a special micrometer variable condenser. The beat frequency is observed as a simple Lissajous figure on a cathode-ray oscillograph using the mains frequency as a time base.   T. H. G.

Aperture error of electrostatic tube lenses. E. GUNDERT (Z. Physik, 1939, **112**, 689—690).—Apparatus for measuring this error is described and the dependence of the error const. on the ratio of the diameters of the two cylinders is calc. The error is least when both cylinders have the same diameter. Reduction of the diameter of either produces an increment in the error which is less for the case where the cylinder nearer the image is the smaller.
      L. G. G.

Generalisation of coincidence devices. Anti-coincidences and their application to the study of cosmic rays. S. GORODETZKY (Compt. rend., 1939, **208**, 1987—1989).—Coincidence and anti-coincidence counters are connected to valves fed by a common anode resistance. The grid circuits are so arranged that the coincidence counter valves pass anode current with the counters at rest, and the anti-coincidence valves only when the counters function. Simultaneous impulses in both counter groups are thus not counted in the anode circuit, but impulses

given only by the coincidence group are recorded. The arrangement gives more accurate results, for a given time of measurement, than two separate sets of equiv. coincidence counts. A. J. E. W.

Photo-electric counters with a CuI photo-cathode, filled with ethyl alcohol vapour. D. ILKOVIC (J. Chim. phys., 1939, **36**, 140—146).—The theory of the photo-electric counter is given, and illustrated with reference to data obtained with a counter containing a CuI photocathode in an atm. of EtOH vapour. W. R. A.

Simple method for the control of counter-tube aggregates. C. B. MADSEN (Naturwiss., 1939, **27**, 453—454).—A special amplifying valve may take the place of a thread electrometer used in conjunction with a counter tube. The anode of the valve is connected with a small rod within the valve which acts as a fluorescence anode. A negative impulse on the grid of the valve causes an increase in the fluorescing area. The wire of the counter-tube is connected with the grid of the valve. A circuit is given. A. J. M.

Electro-capillary method [of analysis]. T. I. EFREMENKO (J. Appl. Chem. Russ., 1939, **12**, 297—300).—A Pt anode is placed at the centre of an annular Pt cathode on wet filter-paper, a drop of the solution under analysis is placed under the anode, drops of sp. cation reagents are placed at various points along the cathode, and a current is passed. The presence of cations is indicated by the appearance of coloured patches at various points between the electrodes. R. T.

Registration of coupled cosmic rays. W. KOLHÖRSTER (Physikal. Z., 1939, **40**, 488—490).—An arrangement of counter-tubes involving triple coincidences is described, and results obtained with it are given. A. J. M.

Aperiodic balance. ANON. (J. Sci. Instr., 1939, **16**, 231).—The balance has a capacity of 200 g. and a sensitivity of 0·1 mg. It is air-damped, with an adjustment allowing free swinging if required. The beam can be released very slowly to minimise vibration and a new device ensures that eccentric loading of the pans will not cause them to swing. D. F. R.

Tantalum as a material for standards of mass. W. M. THORNTON, jun. (J. Chem. Educ., 1939, **16**, 157—160).—The results of independent calibrations of three 10-g. wts. of Ta show that when handled with ordinary care 10-g. wts. of this metal remain const. for >1 year. Difficulties in construction preclude the use of larger standards. L. S. T.

Modified burette for micro-analysis of gases. D. C. GRAHAME (Ind. Eng. Chem. [Anal.], 1939, **11**, 351).—A modification of the Blacet–Leighton gas micro-burette (A., 1931, 1027), in which the Hg threads are easily adjusted and do not drift from their set positions, is described. L. S. T.

Sterilisable filtration unit. F. A. HUDSON (Pharm. J., 1939, **143**, 50).—The unit consists of an all-glass Seitz filter fitted to a spherical receiver combined with an air filter and leading to a bell-cover and filling tube. The apparatus, which can be autoclaved assembled, is fitted with a rubber-tube safety valve for operation under gas pressure. F. O. H.

Capacity of fritted filters to withstand chemical attack in analytical work with alkaline liquids. P. H. PRAUSNITZ (Kolloid-Z., 1939, **88**, 96).—Error due to the loss of 2—3 mg. occurring during filtration of hot Fehling's solution can be avoided by subtracting the wt. of the filter determined after, instead of before, filtration (cf. Brintzinger, A., 1939, I, 161). F. L. U.

Improved mercury-sealed micro-absorption tube. R. J. ROBINSON and D. J. DOAN (Ind. Eng. Chem. [Anal.], 1939, **11**, 406).—Alterations in the ordinary Pregl absorption tube so as to take a Hg seal at each end of the tube are described and illustrated. L. S. T.

Modified Schrötter apparatus. P. L. DE ARAUJO FEIO (Rev. Soc. Brasil. Quím., 1939, **8**, 43—46).— CO_3'' and OH' are determined in Schrötter's apparatus, having a graduated dropping funnel by means of which the total alkalinity in terms of H_2SO_4 is determined for the same sample as the CO_3''. F. R. G.

Bubbler tip of Pyrex glass for difficult absorptions. J. R. BRANHAM and E. O. SPERLING (J. Res. Nat. Bur. Stand., 1939, **22**, 701—705).—The tip is made by sealing a no. of Cu wires (diameter 0·1—0·2 mm.), arranged radially, between a cone formed on the end of a glass tube and a circular glass disc. After grinding the edge of the sealed joint to expose the ends of the wires the Cu is dissolved away in warm HNO_3. At moderate pressures these tips furnish small bubbles of uniform size and distribution. J. W. S.

Jones reductor. P. NILAKANTAM and N. JAYA-RAMAN (Ind. Eng. Chem. [Anal.], 1939, **11**, 339).—The lower end of the reductor is bent upwards so that the H_2 which accumulates there may escape easily and not impede the flow of the solution. L. S. T.

Large-size extractor for liquids. F. W. SCHREIBER (Ind. Eng. Chem. [Anal.], 1939, **11**, 340).—An apparatus for the extraction of 40-l. batches of liquid by solvents lighter than H_2O, based on the lines of that described by Palkin et al. (A., 1925, ii, 708), is described and illustrated. Ergonovine at a concn. of 0·025% can be extracted completely by Et_2O in 10—12 hr. The Et_2O lost during an 8-hr. extraction is <500 c.c. L. S. T.

Preparation of grease-free polished surfaces. I. W. WARK (Nature, 1939, **143**, 1024).—Details for the prevention of contamination of polished surfaces of minerals and metals are given. A sensitive test for freedom from contamination is based on the zero angle of contact between an air bubble and a clean solid surface immersed in H_2O. The difficulty of avoiding contamination from the water supply is emphasised. L. S. T.

Needle valve for the micro-Dumas determination of nitrogen. E. B. HERSHBERG and L. SOUTHWORTH (Ind. Eng. Chem. [Anal.], 1939, **11**, 404—405).—The construction and use of a valve

to replace the stopcock between the combustion tube and the azotometer is described. The valve consists of a stainless steel needle which screws into Pyrex capillary tubing and is sealed by Hg. L. S. T.

Continuous supply of hot distilled water. G. G. MARVIN (Ind. Eng. Chem. [Anal.], 1939, **11**, 399).—A 30-gall. gas-fired Whitehead automatic water heater containing a monel tank will supply 60—90 l. at 85° for 3 hr. The H_2O contained traces of Ni but no Cu. L. S. T.

Improved three-way stopcock. M. A. SMITH and F. L. HAYES (Ind. Eng. Chem. [Anal.], 1939, **11**, 397).—In three-way stop-cocks with two stems on one side and one on the other, the risk of leakage is minimised by placing the two holes in the central tap at right angles to each other. L. S. T.

Solenoid stirring device for use in confined spaces. H. H. BOWLEY and R. B. ANDERSON (Ind. Eng. Chem. [Anal.], 1939, **11**, 397).—A solenoid, controlled by a make-and-break device, is placed about the upper part of the cell or tube containing liquid, and raises the closed glass stirrer, the upper part of which encloses an Fe core. L. S. T.

Meniscus reader. E. J. BOGAN (Ind. Eng. Chem. [Anal.], 1939, **11**, 396).—The reader is modified so that it can be easily snapped on and off the burette, without moving the latter from its stand. L. S. T.

Greaseless high-vacuum valve. R. H. CRIST and F. B. BROWN (Ind. Eng. Chem. [Anal.], 1939, **11**, 396).—The valve seat is made of Ag with AgCl as the seating surface and presses against the polished end of a Pyrex valve stem. L. S. T.

Continuous extraction diffusion device. M. MEYER (Ind. Eng. Chem. [Anal.], 1939, **11**, 369). L. S. T.

Measurement of surface tension by the static depolished plate method. M. ABRIBAT and A. DOGNON (Compt. rend., 1939, **208**, 1881—1882).—The pull on a plate partly immersed in the liquid is measured by applying an opposing force. Roughening of the plate, which is preferably of Pt, ensures perfect wetting. A. J. E. W.

Apparatus for determining percentage composition. L. D. JOHNSON (J. Chem. Educ., 1939, **16**, 229—230). L. S. T.

Rapid calculation of relative humidity from readings of the Sling hygrometer. A. J. TURNER (Nature, 1939, **143**, 897).—% R.H. = 100 — $300[(\theta - \theta')/\theta]$, where θ and θ' are the dry- and wet-bulb temp. (°F.) of a ventilated hygrometer. The formula applies at R.H. >30% over an air-temp. range of 20—140° F. L. S. T.

Mechanical device for smoothing data. T. SCHUMANN (Nature, 1939, **143**, 937—938).—The device described and illustrated eliminates the computations involved in obtaining a smooth curve from a series of observations. L. S. T.

Apparatus for dispensing dry gaseous and liquid ammonia. C. H. ALMFELT and C. R. MCCROSKY (J. Chem. Educ., 1939, **16**, 193—194).—Apparatus for condensing NH_3 from a cylinder on

to dry NH_4CNS cooled by ice is described. Pure, dry liquid NH_3 can then be obtained by allowing the gas to condense in a vessel surrounded by $CO_2 + Et_2O$. L. S. T.

Apparatus for the study of systems comprising one liquid and one solid phase. L. DOMANGE (Bull. Soc. chim., 1939, [v], **6**, 1255—1257).—A glass reservoir, fitted with a pipette which also acts as stirrer, is arranged in a centrifuge tube, the temp. of which is controlled thermostatically. When the mixture has attained equilibrium it is centrifuged, the liquid drawn into the pipette, and the moist solid left in the reservoir. Both the reservoir and pipette are provided with ground glass caps to facilitate rapid closure when the vessels are removed from the thermostat. J. W. S.

Small hygrometer. D. E. HOWELL and R. CRAIG (Science, 1939, **89**, 544).—An instrument suitable for use in small spaces without changing the humidity is described. L. S. T.

High resolving power ultra-centrifuge. J. W. BEAMS (Science, 1939, **89**, 543—544). L. S. T.

Simplest transparent ultra-centrifuge. J. W. MCBAIN and A. H. LEWIS (Science, 1939, **89**, 611—612).—An air-driven, transparent ultra-centrifuge permitting photographic recording of the contents of a glass or quartz tube rotating at $110,000g$ is described and illustrated. L. S. T.

Funnel-heating device. L. N. MARKWOOD (Science, 1939, **89**, 612).—The funnel is fitted into a metal jacket and steam-tight connexions are effected by a rubber bung at the bottom and a rubber gasket at the top. Steam impinges directly on the glass funnel near the top. Alcoholic solutions can be kept at the b.p. L. S. T.

Determination of the viscosity of liquids. C. SĂLCEANU (Compt. rend., 1939, **208**, 1797—1799).— η vals. are compared by observing the lengths of liquid column (l) displaced through a capillary tube by a const. instantaneous force, conveniently applied by a falling piston; $\eta_2/\eta_1 = (l_1/l_2)^2$. An apparatus is described. A. J. E. W.

Micro-viscosimeter. J. R. BOWMAN (Ind. Eng. Chem. [Anal.], 1939, **11**, 409—411).—The apparatus described and illustrated has an abs. accuracy better than 4%, and a precision within 0·1% in the range 2—10,000 centistokes. The method requires 1 drop (~ 0·03 g.) of sample. L. S. T.

Edge correction in the determination of dielectric constant. A. H. SCOTT and H. L. CURTIS (J. Res. Nat. Bur. Stand., 1939, **22**, 747—775).—Theoretical formulæ for the edge correction in the determination of the ϵ of solid insulating materials using various forms of electrode are discussed. Empirical equations for the correction are derived; they are simpler to apply than the theoretical equations. J. W. S.

C. A. Munroe. C. A. BROWNE (J. Amer. Chem. Soc., 1939, **61**, 1301—1316). W. R. A.

Ludwig Mond. F. G. DONNAN (Proc. Roy. Inst., 1939, **30**, 709—736).

Geochemistry.

Dissymmetry of ozone distribution in the two hemispheres. (Mme.) A. Vassy and E. Vassy (Compt. rend., 1939, 208, 1829—1830).—Vals. of the mean reduced thickness of atm. O_3 are 8—11% greater for the southern than for the northern hemisphere. The discrepancy may represent a difference in the actual amounts of O_3, or it may be due to varying distribution with latitude.   A. J. E. W.

Seasonal variations of the amounts of ozone and comparison of the amounts contained in the marine and urban regions of Rimini. F. Vascellari (Boll. Chim. farm., 1939, 78, 289—296).—Details are given of the monthly variation of the O_3 content of the atm. under different climatic conditions. In general the O_3 content of sea-air is > that of the urban air, especially during January to March.
                                                        O. J. W.

Atmospheric ozone. D. Barbier and D. Chalonge (J. Phys. Radium, 1939, [vii], 10, 324—325).—A reply to the criticisms of Vassy (cf. A., 1939, I, 391).
                                                        W. R. A.

Noble gas content of air dissolved in water. J. A. M. van Liempt and W. van Wijk (Chem. Weekblad, 1939, 36, 555).—Air dissolved in rain, river, or tap H_2O contains $\sim 1.8\%$ of noble gases, whilst atm. air contains 0.94%.   S. C.

Deuterium–protium ratio. I. Densities of natural waters from various sources. C. H. Greene and R. J. Voskuyl (J. Amer. Chem. Soc., 1939, 61, 1342—1349).—The ρ of samples of water of widely different origins have been determined by measuring the pressure at which a Pyrex, Hg-weighted, thick-walled, stream-lined float is exactly balanced. Details of the method and of the purification of H_2O (three distillations at atm. pressure, followed by two in an evacuated all-glass apparatus) are given. During low-pressure distillation isotopic fractionation occurs, and the necessary corrections have been applied, together with corrections for distillation at atm. pressure.   W. R. A.

Salinity of the subterranean waters of the western part of the interior delta of the Niger. M. Enikeff (Compt. rend., 1939, 208, 2094—2097).—The salinity variations (studied by electrical resistance measurements) are discussed in relation to the origin of the waters (p_H 6.7—6.8), which contain O_2 0.0005—0.0016, Cl 0.0117—0.027, Mg 0.004—0.013, and CaO 0.084% (one sample).   A. J. E. W.

Analysis of mineral water of Pieve di Cusignano (Parma). G. Illari and S. Beati (Annali Chim. Appl., 1939, 29, 212—219).—Data for physico-chemical and chemical characteristics and for ionic activities are tabulated.   F. O. H.

Spectrographic analysis of [mineral] water of Fonte di Fiuggi [Italy]. R. Intonti (Annali Chim. Appl., 1939, 29, 205—212).—Metals detected in the dry residue of the H_2O are listed and discussed.
                                                        F. O. H.

Physical chemical analysis in the chemical survey of the Marseilles canal water. F. Rimattei, (Mme.) L. Grimaud, and C. Gerbeau (Ann. Hyg.

Publ., 1939, 18, 145—151).—The max. variation in the electrical conductivity of the canal water at different localities is 9.22%, increasing threefold on dilution 100 times with pure H_2O. The p_H is approx. const. at 8.0 ± 0.2. The measured conductivity of samples agrees with that calc. from Diénert's formula, using the vals. of the OH, SO_3, and NO_3 content obtained from chemical analysis.   D. F. R.

Variation of the composition of the water of Lake Geneva. P. Balavoine (Arch. Sci. phys. nat., 1939, [v], 21, Suppl., 36—38).—The salt content of the surface-H_2O of Lake Geneva begins to decrease in April and continues to do so until September, after which it increases again until December. This effect, which is not observed for H_2O from a depth >25 m., is due mainly to variations in the concn. of carbonates, and is attributed to the decrease in solubility of the latter owing to the rise in temp. of the H_2O.
                                                        J. W. S.

Organic matter in the waters of the Barentz, Polar, and Kara Seas. B. A. Skopintzev (Compt. rend. Acad. Sci. U.R.S.S., 1939, 22, 448—451).—Data showing oxidisability ($KMnO_4$ consumption) and p_H are recorded. The large variations in oxidisability at different stations are discussed. Vals. of p_H vary between 8.11 and 8.23.   L. S. T.

Spectrum analysis of the water supply of Bell Ville (Cordoba, Argentina). Determination of vanadium. F. Charola (Anal. Asoc. Quím. Argentina, 1939, 27, 35—40).—By spectrographic methods it is shown that Na, Ca, Ba, Mg, Al, Si, Mn, Mo, Fe, Cu, and K together with 1.46 mg. V per l. are present.
                                                        F. R. G.

Distribution of ammonia in waters of the Gulf of Maine. A. C. Redfield and A. B. Keys (Biol. Bull. Wood's Hole, 1938, 74, 83—92).—In the deeper basins the $[NH_3]$ is fairly uniform at all depths in September, whereas in May it is greatest between 30 and 60 m. In the tideways the concn. at all depths was uniform both in May and September and in shallow H_2O it was irregular. The occurrence of NH_3 is similar to that of dissolved org. P compounds. The distribution with depth of NH_3 in May is closely similar to that of NO_2', supporting Rakestraw's view that the latter is formed by oxidation of the former. Both are absent from the surface layer, probably owing to assimilation by plankton. The regions of highest $[NH_3]$ are those in which zooplankton is also abundant.   A. D. H.

Analyses of the mineral waters of Varano Marchesi (Parma). II. G. Illari, P. Piana, and E. Lasagni (Annali Chim. Appl., 1939, 29, 152—166; cf. A., 1939, I, 106).—Chemical composition and physico-chemical properties of two other waters are recorded.   O. J. W.

Clay pool containing sulphuric acid at Reinbek. W. Ohle (Arch. Hydrobiol., 1936, 30, 604—662; Chem. Zentr., 1937, i, 1652).—The artificial pool described contains 30 mg. of H_2SO_4 per l. (p_H 3.1—3.6), resulting from the weathering of clay containing pyrites.   A. J. E. W.

[Absorption of ammonia by] snow. P. BALA-VOINE (Arch. Sci. phys. nat., 1939, [v], **21**, Suppl. 38—39).—Observations of the NH_3 content of snow and hoar-frost indicate that the absorption of NH_3 by snow occurs, not only during the snowfall, but also subsequently. J. W. S.

Rosebud meteorite, Milam Co., Texas. F. M. BULLARD (Amer. Min., 1939, **24**, 242—254).—The meteorite consists mainly of olivine chondrules in a matrix of silicate minerals, metal, and troilite. Olivine comprises >50% of the meteorite, with metal next in abundance, followed by pyroxenes (enstatite-hypersthene), and with troilite, glass, chromite (?), schreibersite, and Fe oxide (?), in small amounts. Chemical analyses of the sol. and insol. silicate and metallic portions, as well as a composite analysis, are recorded. Traces of Ge, Ba, and V were also detected spectrographically. L. S. T.

Measurement of the amount of steam escaping from areas of volcanic or solfataric activity. S. H. WILSON (Nature, 1939, **143**, 802—803).—A method is described, and results for active centres at Mt. Tongariro, N.Z., and White Island are given. L. S. T.

Marsh gas in the ecology of some peat bogs. H. A. ALLARD (Science, 1939, **89**, 533—535).—Large quantities of CH_4 are entrapped beneath the roots of sedges and org. ooze present in Grassy Pond, Oxford, Mass. The CH_4 appears to be physiologically inert and may act only as a diluent of O_2. L. S. T.

Determination of boron etc. in boron minerals. E. F. GÖBEL (Rev. Chim. Ind., 1939, **8**, 266—269).—H_2O, SiO_2, $Fe_2O_3 + Al_2O_3$, CaO, MgO, Na_2O, SO_3, CO_2, NaCl, Cl, and B_2O_3 contents are recorded for S. American ulexite and rasorite (kernite) and for Tibetan borax (tincal). F. R. G.

Lamellar structure of potash–soda felspars. S. H. CHAO and W. H. TAYLOR (Nature, 1939, **143**, 1024—1025).—X-Ray examinations of K_2O–Na_2O orthoclase felspars with microperthitic structures indicate that in both of the structure types observed the K_2O felspar is present as a monoclinic component. Further, while in the low-Na_2O type the triclinic Na_2O felspar lamellæ are twinned on the pericline law, in the high-Na_2O type they are twinned on the albite law. L. S. T.

Mica-pegmatites of Kodarma, India. S. K. ROY, N. L. SHARMA, and G. C. CHATTOPADHYAY (Geol. Mag., 1939, **76**, 145—164).—Structure and origin are discussed. L. S. T.

Kruger alkaline syenites of Southern British Columbia. C. D. CAMPBELL (Amer. J. Sci., 1939, **237**, 527—549).—The mineralogy, petrography, and genesis of the Kruger syenites are described and discussed. L. S. T.

Presence of sodium-containing orthoclase in the syenitic rocks of Divrik (Turkey). M. GYSIN (Arch. Sci. phys. nat., 1939, [v], **21**, Suppl., 39—42). —The crystal angles of the felspar occurring on the north side of the magnetite seam in Divrik indicate that it includes Na-containing orthoclase. J. W. S.

Polymorphism of the micas and diffuse X-ray scattering of layer silicate lattices. S. B. HEN-DRICKS (Nature, 1939, **143**, 800).—X-Ray examination of many micas reveals a great variety of structure. In biotite-like micas, the Al silicate layers are stacked in a variety of ways preserving 12-fold co-ordination of interlayer K ions. Diffuse scattering of X-rays by some biotites is a result of random combination of types of stacking. Incomplete filling of the octahedral co-ordination positions in muscovite leads to distortion of the co-ordination and therefore of the layer; as a result, there is only one way in which the 12-fold co-ordination of K between layers can be obtained. L. S. T.

Obsidian-like rock formed from the melting of a granodiorite. E. S. LARSEN and G. SWITZER (Amer. J. Sci., 1939, **237**, 562—568).—An egg-shaped inclusion of granodiorite ~50 ft. long and 40 ft. wide, included in a plug of andesite at Calaveras Quarry, San Diego Co., California, has undergone partial fusion, and appears as a black obsidian-like glass containing abundant phenocrysts of quartz, plagioclase, and augite. The perthite, biotite, and hornblende of the granodiorite have disappeared in the partly-fused mass, the perthite being incorporated in the glass, and the biotite and hornblende being replaced by diopside and Fe ore. The glass contains 4·57% of H_2O, and only H_2O has been added to the inclusion during the partial fusion. The fluxing action of H_2O probably made the fusion possible. Chemical analyses of the andesite plug, the Green Valley tonalite which is the parent rock of the inclusion, the partly-fused inclusion, and the glass of the inclusion are recorded. Photomicrographs of the fused inclusion are reproduced. L. S. T.

Granodiorite from Zsidóvár. T. TAKÁTS (Mat. Term. Értesitö Tud. Akad. III, Oszt. Fol., 1936, **54**, 882—892; Chem. Zentr., 1937, i, 1652).—The grano-diorite contains SiO_2 63·12, TiO_2 0·11, Al_2O_3 18·99, Fe_2O_3 1·73, FeO 1·73, MnO 0·13, MgO 2·19, CaO 4·83, Na_2O 3·25, K_2O 2·25, P_2O_5 0·19, and constitutional H_2O 1·24%. Inclusions and cavities contain a variety of minerals, including laumontite (SiO_2 52·24, Al_2O_3 22·14, CaO 10·55, Na_2O 0·31, K_2O 0·43, constitutional H_2O 15·14%, MgO trace) and desmine (SiO_2 55·95, Al_2O_3 16·72, Fe_2O_3 0·32, CaO 7·74, SrO 0·01, Na_2O 0·78, constitutional H_2O 17·06, H_2O evolved at 100° 1·67%). A. J. E. W.

Manosque (Lower Alps) deposits of asphaltic limestone and sulphur.—See B., 1939, 822.

Vesuvianite and fluorescent apatite from Center Strafford, New Hampshire. G. W. STE-WART (Amer. Min., 1939, **24**, 274—275). L. S. T.

World distribution of serpentinised peridotites and its geologic significance. H. H. HESS (Amer. Min., 1939, **24**, 275—276). L. S. T.

Pitchblende ore from Great Bear Lake, Canada. J. P. MARBLE (Amer. Min., 1939, **24**, 272—273; cf. A., 1937, I, 538).—Chemical analyses of two ore samples, one of which has provided the material for many earlier age investigations, are recorded. L. S. T.

Fluorescence experiments with secondary uranium minerals. H. MEIXNER (Naturwiss., 1939, **27**, 454).—U minerals which fluoresce strongly in ultra-violet light may be classified into two types : (*a*) autunite type (autunite, uranospinite, uranocircite, trögerite, etc.) and (*b*) schröckingerite type. The fluorescence of (*a*) is yellowish-green, and of (*b*) pure green. Differences in the position and no. of fluorescence bands occur between and within the groups. Secondary U minerals show either a weak fluorescence, or none at all. Many of those which fluoresce feebly have been altered only on the surface, or have been weathered, arising from non-fluorescing minerals (torbernite, zeunerite, bassetite, etc.). The autunite type consists of U phosphates, arsenates, and sulphates, whilst the schröckingerite type consists of U carbonates. The non-fluorescing minerals are silicates. The presence of certain metals (Cu, Pb, Bi, Fe) may cause non-fluorescence. This classification may be used to investigate the nature of a U mineral, and indicates that bassetite is $Fe(UO_2)_2(PO_4)_2.xH_2O$ ($x = 8$ or 12), and not $Ca(UO_2)_2(PO_4)_2.8H_2O$.
A. J. M.

β-Uranotile. V. STEINOCHER and R. NOVÁČEK (Amer. Min., 1939, **24**, 324—338).—β-Uranotile (I) from Joachimstal has ρ 3·953 and SiO_2 13·11, UO_3 66·29, CaO 7·32, H_2O 12·87, CO_2 present, total 99·59%, giving the formula $CaO,2SiO_2,2UO_3,6H_2O$. (I) from Bedford, N.Y., and from Mitchell Co., N. Carolina, has been incorrectly identified (A., 1935, 323) as schroeckingerite. (I) from Wölsendorf has ρ 3·85 and SiO_2 12·9, UO_3 66·9, CaO 7·1, H_2O 12·6, total 99·5%. Optical data for these samples of (I) are recorded.   L. S. T.

Classification of the minerals of the serpentine group. N. E. EFREMOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 432—435).—*Kolskite*, $5MgO,4SiO_2,4H_2O$, ρ 2·401, hardness 2—3, n 1·542, occurs at Saig Lake, the Kola peninsula. The endo- and exo-thermal effects observed in a thermal analysis are those typical of serpentine minerals. The X-ray powder diagrams of this mineral and of silky chrysotile asbestos from the Markopidge region, deveilite from the Tkhacha region, and kerolite (II) from the Beden region show typical serpentine lines. With adigeite, ishkildite, hydroforsterite (I), and karachaite (III) these form a series of serpentine minerals in which the intermediate members are combinations of a mol. of the (I) type and a mol. of the (III) type, with the ratio MgO : SiO_2 varying from 2 in (I) to 1 in (II) and (III).   L. S. T.

Identity of monite, zeugite, spodiosite, and apatite. H. STRUNZ (Naturwiss., 1939, **27**, 423).—X-Ray powder diagrams of monite, zeugite [hydrated $Ca_3(PO_4)_2$], and spodiosite $[4Ca(F,Cl)_2 + 5Ca_3(P,As)_2O_8]$ are identical with that of apatite. Monetite ($CaHPO_4$) gives a diagram different from that of apatite.   A. J. M.

Eusynchite, aräoxene, pyrobelonite, and descloizite. H. STRUNZ (Naturwiss., 1939, **27**, 423).—Eusynchite and aräoxene (hydrated Pb Zn vanadates) gave identical X-ray powder diagrams, and eusynchite from another source was identical with pyromorphite. The name eusynchite may be extended to cover descloizite, $(VO_4/OH)ZnPb$, and aräoxene retained for descloizite containing As, $[(V,As)O_4/OH]ZnPb$. Pyrobelonite, $(VO_4/OH)MnPb$, gave a rotating crystal diagram with lattice consts. corresponding with those of descloizite.   A. J. M.

Microscopical characters of some manganese minerals found in the lateritic manganese ore of Belgaum District, S.W. India. S. DEB (Current Sci., 1939, **8**, 258—260).—Hollandite (I) and romanéchite (II) occur side by side with psilomelane and polianite, the two essential minerals of the ore. Reflecting powers of these minerals and their behaviour with HCl, H_2SO_4, H_2O_2, etc. are recorded. (I) and (II) are distinct species.   L. S. T.

Petrography and petrology of the Lower Cambrian manganese ore of W. Merionethshire. A. W. WOODLAND (Quart. J. Geol. Soc., 1939, **95**, 1—35).—The ore occurs as a band, ~1 ft. thick, interbedded with gritty and muddy rocks. The normal rocks associated with the ore, especially those above it, are markedly manganiferous. The ore is a hard flinty rock with a semi-conchoidal fracture, banded with alternations of red, yellow, and bluish-black materials. The red and yellow portions are essentially spessartite (I) and dialogite (II), with rare amounts of rhodonite. The black bands contain small amounts of pyrolusite. The colour of the red layers is due to small quantities of finely-divided hæmatite included in the (I). The MnO content of the ore varies from 37 to 49%, with a progressive increase from the red to the black material. The % of garnet varies from 50 in the red to 20 in the cream and black ores. The presence of (I) indicates considerable metamorphism. The ore is sedimentary, and was originally laid down as a mixture of (II) with clayey and siliceous materials, probably as a gel. The origin of the ore is discussed. Chemical and mineralogical analyses of the ore rock and the contained garnet are recorded.   L. S. T.

Occurrence of chrysoberyl near Golden, Colorado. W. A. WALDSCHMIDT and R. V. GAINES (Amer. Min., 1939, **24**, 267—271).—Unusually large crystals and cryst. masses of chrysoberyl occur in a granite pegmatite near Drew Hill, Golden, Colorado. The analysis [W. P. SCHODER] is BeO 19·15, Al_2O_3 76·34, FeO 3·60, TiO_2 0·55, SiO_2 and MnO traces, Cr none, loss on ignition 0·30% ; ρ is 3·648.   L. S. T.

Muscovite. G. W. VOLK (Amer. Min., 1939, **24**, 255—266 ; cf. A., 1925, ii, 592).—Chemical analyses and optical consts. of 22 samples of muscovite from different parts of the world are recorded. Before analysis the samples were freed from inclusions by means of heavy liquids and from free Fe oxide by means of H_2S and dil. acid. The formulæ for the three members of the muscovite system that correspond most accurately with the chemical composition are K muscovite, $H_4K_2Al_6Si_6O_{24}$, phengite (I), $H_6K_2(Fe,Mg)_2Al_4Si_6O_{24}$, and Fe^{III} muscovite (II), $H_4K_2Fe^{III}_2Al_4Si_6O_{24}$. The formula for (I) is modified from that generally accepted. η rises when the (II) content of the system increases. The optic angle decreases with an increase in the amount of (I), and when small amounts of (I) are present with large amounts of (II).   L. S. T.

Goldschmidtine, a newly-recognised antimonide of silver. M. A. Peacock (Amer. Min., 1939, 24, 227—241).—Fuller details (cf. A., 1939, I, 344) are recorded. L. S. T.

Crystal structure of nacrite, $Al_2O_3,2SiO_2,2H_2O$, and polymorphism of the kaolin minerals. S. B. Hendricks (Z. Krist., 1939, 100, 509—518; cf. Gruner, A., 1933, 45, 892).—From analysis of Weissenberg and rotation X-radiograms of single crystals (Colorado), the cell is monoclinic (pseudohexagonal) with a 8·94, b 5·14, c 43·0 A., β 90° 20′; six $[(OH)_8Al_4Si_4O_{10}]$ per cell; space-group C_s^4—Cc. The layer structure found to accord with intensities is discussed with those of kaolinite, dickite, and halloysite, in terms of the OH linkage involved in the various methods of stacking the $[(OH)_4Al_2Si_2O_5]_n$. I. McA.

Granite from Hołyczówka (Wolhynien). J. Wojciechowski (Arch. Min. Soc. Sci. Varsovie, 1936, 12, 96—117; Chem. Zentr., 1937, i, 1400).—The granite [quartz 32·5, plagioclase ($Ab_{92}An_8$—$Ab_{87}An_{13}$) 32·4, orthoclase + microcline 22·8, biotite 5·6, muscovite 5·3, apatite 0·3, other minerals 1·1 mol.-%] is described and compared with surrounding deposits. A. J. E. W.

Crystallisation of the Rockville granite, Minnesota. E. Tatge (Amer. Min., 1939, 24, 303—316).—Minerals of the granite are described and their paragenesis is discussed. A chemical analysis [F. F. Grout and F. J. Pettijohn] of the granite is given. L. S. T.

Rational quantitative mineralogical classification of granitoids. B. M. Kupletski and O. I. Kovaleva (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 557—560).—The boundaries of a series of rock groups are defined on a tetrahedral diagram, on the basis of the proportions of quartz, orthoclase, plagioclase, coloured and secondary minerals found in a large no. of specimens. L. J. J.

Lateritic decomposition of granite in the Macenta region (French Guinea). J. de Lapparent (Compt. rend., 1939, 208, 1767—1769).—Three stages in the decomp. are distinguished : (a) slight decomp. with formation of sericite from Ca Na felspars; (b) sand formation; (c) loss of mica and formation of kaolin from the sand, and production of gibbsite in the granite masses, which retain their mica. A. J. E. W.

Metasomatic origin of the Adirondack magnetite deposits. H. L. Alling (Econ. Geol., 1939, 34, 141—172; cf. ibid., 1925, 20, 335).—Examination of numerous thin sections from most of the mines and prospects of the Adirondacks shows that the ore is due largely to high-temp. metasomatic replacement. The wall rocks show that a series of overlapping processes involving differentiation, assimilation, crystallisation, contact action, and various introductions has taken place. The textural minerals of the wall rock are described. L. S. T.

Oxidation of magnetite. Variation of the rate of oxidation at the Curie point. R. Lille (Compt. rend., 1939, 208, 1891—1893).—The oxidation of natural Fe_3O_4 at 410—800° is followed by χ measurements. At $<600°$ oxidation is rapid for ~ 1 min. and then almost ceases owing to formation of a protective layer of Fe_2O_3; after ~ 30 min. fissures develop in this layer, and oxidation continues slowly. At $>600°$ oxidation is slow but continuous after ~ 5 min., owing to appreciable diffusion of O_2 through the layer. An abrupt increase and a slight anomaly in the rate of oxidation occur at 570° and 675°, the Curie points of Fe_3O_4 and Fe_2O_3, respectively. The anomaly is possibly due to a change in the rate of diffusion. A. J. E. W.

Thermal dissociation of zinc carbonate. A. Rose (Compt. rend., 1939, 208, 1914—1916).—Thermal decomp. of a smithsonite (I) crystal gives oriented ZnO crystals which are shown by the X-ray diagrams to have a $(10\bar{1}0)$ face parallel to one of the original e^3 $(3\bar{1}1)$ faces, and prism edges parallel to rhombohedron edges of binary axes of the original crystal. This shows that a small translation (1·9 or 2·3 A.) of Zn atoms along the $[112]$ or $[110]$ axes and a 0·5 A. displacement of O atoms occurs on decomp., giving the ZnO structure. The loss of CO_2 from a (I) crystal is retarded soon after commencement of decomp., owing to formation of a ZnO layer, but after a further period of heating fissures develop due to growth of the ZnO grains, and decomp. is accelerated. A. J. E. W.

Mechanism of cation exchange in the montmorillonite–beidellite–nontronite type of clay minerals. J. E. Gieseking (Soil Sci., 1939, 47, 1—13).—Absorption of large substituted NH_4 ions by these clay types results in wider spacings in the crystal lattice than those produced by smaller ions. X-Ray diffraction is correspondingly intensified to extents which ultimately reach a max. val. The adsorbed large complex ions are replaceable by others of similar size but not by H˙. The complex ions are highly effective in coagulating the clay. Montmorillonite saturated with the complex ions does not show the characteristic absorption of H_2O and swelling, and the (001) lattice spacings are unaffected by the total H_2O content of the system. A. G. P.

Silicious fossils. M. Déribéré (Rev. Soc. Brasil. Quím., 1939, 8, 47—58).—A review of the occurrence, constitution, and applications of kieselguhr, with analyses of samples from France, Algeria, Germany, U.S.A., and S. Africa. F. R. G.

Gravitational accumulation of olivine during the advance of basaltic flows. R. E. Fuller (J. Geol., 1939, 47, 303—313).—Late Tertiary basaltic flows in S.E. Oregon show locally a surface depletion and a basal concn. of olivine (I) above a chilled basal zone containing scattered phenocrysts of (I). The ferromagnesian grains appear to have accumulated gradually in a manner analogous to the deposition of sand at a river delta. Three chemical analyses [W. H. and F. Herdsman] are recorded. L. S. T.

Viscosity of lava. R. L. Nichols (J. Geol., 1939, 47, 290—302).—A study of the Alika flow of Hawaii. L. S. T.

Pyrosynthesis, microscope study, and iridescent filming of sulphide compounds of copper with arsenic, antimony, and bismuth. A. M. Gaudin and G. Dicke (Econ. Geol., 1939, 34, 49—81,

214—232).—The minerals synthesised by melting the appropriate elements with S in a bomb are : chalcocite, covellite, famatinite (three varieties, and an arsenical solid solution, probably stibioluzonite), tetrahedrite (three varieties), chalcostibite, stibnite, enargite and an antimonial solid solution, probably luzonite, tennantite I and II, realgar, two As–S glasses, bismuthinite, cuprobismutite (I), klaprothite, and two allotropic (?) forms of wittichenite. The temp. at which the phases solidified are $>$ those at which Ag sulpho-salts solidify. The solid solutions observed are of the type in which one atom of the lattice is replaced by another rather than of the interstitial type in which the lattice is disarranged. The optical character and the iridescent filming behaviour (B., 1938, 662) of these minerals are recorded and the composition and structure of the various phases, and the solid solution effects, are described and discussed. A diagram for a part of the system Cu–Bi–S is reproduced. CuS,Bi_2S_3, instead of $3Cu_2S,4Bi_2S_3$, is the formula proposed for (I). L. S. T.

Ruby Gulch gold mining district, Little Rocky Mountains, Montana. J. L. DYSON (Econ. Geol., 1939, **34**, 201—213).—The ore deposits, which are low-grade, are worked primarily for Au. They yield some Ag. In the ore zones, quartz (I) is the most abundant mineral and pyrite (II) is common. Fluorite (III) is common locally. Some relatively high-grade ore consists of a mixture of (I), (II), (III), Au, and sylvanite (IV). The ores were deposited apparently by ascending hydrothermal solutions under conditions characteristic of epithermal deposits, and the general order of deposition was (I), (II), sericite (V), Au; (I), (II), (V), calcite (?); (III); Au and (IV). L. S. T.

Geology of a portion of the Lupa goldfield [E. Africa]. D. GALLAGHER (Econ. Geol., 1939, **34**, 243—267).—The general geology, petrography, and data regarding the nature and origin of the lenticular Au veins are described. The region is composed of complex, pre-Cambrian, igneous rocks in which abundant Au quartz veins occur. These were deposited metasomatically in fracture channelways by solutions genetically related to a widespread invasion of the region by alaskite. A chemical analysis [F. OATES] of the alaskite is recorded. L. S. T.

Ore geology of the Day Dawn mine, New Guinea. N. H. FISHER (Econ. Geol., 1939, **34**, 173—189).—The ore geology, the genesis of the lode, the occurrence and distribution of the Au, and the distribution of the Ag are described. Ag vals. are high, and the ratio Ag : Au is ~30 : 1, but Ag is probably mostly contained in an insol. manganite. L. S. T.

Origin of the Sweetwater, Tennessee, barite deposits. R. A. LAWRENCE (Econ. Geol., 1939, **34**, 190—200).—These deposits are of the simple fissure-filling type and are underlain by irregular fissure-veins in Beekmantown dolomite. The veins are associated with dolomitised limestone. Calcite, pyrite, fluorite, and barite are the only common minerals of these deposits, and were deposited in this order. Deposition from ascending thermal waters is indicated. L. S. T.

" Acidity " of quartz. G. VAN PRAAGH (Nature, 1939, **143**, 1068).—The lowering of the p_H of H_2O which results from the addition of powdered quartz is probably due not to H_2SiO_3, but to adsorbed CO_2. This view is supported by heating (300°) and cooling the quartz in a vac., after which addition to H_2O has no effect on p_H. The vol. of gas evolved is sufficient to account for the observed lowering of p_H. Addition of NaCl increases the acidity of the quartz–H_2O system owing to the decrease in $[HCO_3']$ by $Na^.$. L. S. T.

Unit cells of quartz and chalcedony. M. KOŁACZKOWSKA (Arch. Min. Soc. Sci. Varsovie, 1936, **12**, 82—89; Chem. Zentr., 1937, i, 1399).—Vals. of a, c (in A.), c/a, and V (in cu. A.) are as follows : chalcedony, 4·718, 5·275, 1·117, 102·20; hydrothermal quartz, 4·903, 5·393, 1·099, 112·28; granite quartz, 4·964, 5·430, 1·093, 115·93.
A. J. E. W.

Evolution of calcium phosphate in the Toarcien de l'Échelle (Ardennes). A. BONTE (Compt. rend., 1939, **209**, 53—56; cf. *ibid.*, 1938, **206**, 1494).—A qual. analysis has been made of the different levels in a cutting at Toarcien de l'Échelle. The determination of P (as P_2O_5) in the different levels leads to the following scheme for the evolution of the phosphate : solidification, modification, dissolution, crystallisation, and diffusion. W. R. A.

Chemical composition of zircons. E. KOSTILEVA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 167—169).—Anomalous variations among different zircons are discussed. Reported analytical discrepancies are ascribed to neglect of traces of other elements. Varying solubility of zircons in HF is due to metamictic decomp. and to heterogeneity of composition. The extent of decomp. of Ceylon zircons into ZrO_2 and SiO_2 $\propto$ the amount of U isomorphously enclosed, and α-particles may also be the cause of green and black colorations. J. A. K.

Herrengrundite from the Uspensky mine in Kazakhstan. F. V. TSCHUCHROV and V. M. SENDEROVA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 165—166).—Deposits on the walls of an old Cu mine had the composition $CaO,4CuO,2SO_3,6H_2O$, and have been identified as herrengrundite. Genesis of this mineral by percolating H_2O is discussed. The Uspensky specimens cannot be >40 years old.
J. A. K.

Hyalophane from the Slyudyanka mine. P. V. KALININ (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 163—164).—Rocks associated with certain phlogopite veins are described. The physical properties and chemical composition of a Ba felspar similar to Swedish hyalophanes are recorded. J. A. K.

Content of rare and other elements in the cassiterites of different genesis from U.S.S.R. deposits according to spectro-analytical data. S. A. BOROVIK and J. D. GOTMAN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 351—354).—Spectrum analysis of 27 specimens of cassiterites of different origin are reported and the presence of various elements is indicated. In cassiterites of pegmatite veins Nb, Ta, Zr, Fe, and Mn are present and often Ga, Be, and Hf, but no V. Cassiterites from quartz,

quartz-felspar, and sulphide cassiterite veins are quite different from those from pegmatite veins in containing considerable V and some W, In, and Mn. Wood tin contains Pb, Zn, Mo, Sb, and Ge. None of the specimens contained Ag, Cd, Co, Ni, K, As, Ba, or Sr.
W. R. A.

Allanite from the Abukuma granite region. S. HATA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 112—129).—Analyses of specimens of allanite from new localities in the Abukuma granite region confirm Machatschki's formula $X_2Y_3Z_3(O,OH)_{13}$ ($X =$ Ca, Mn, Th, rare-earth elements; $Y =$ Fe, Al, Mg, Ti; $Z =$ Si, P) (cf. Centr. Min., 1930, **A**, 89, 153). The amounts of Mn and of rare-earth elements in X varies widely with the locality. The colour of the streak in allanite varies from dark green to brown and is related to the proportion of Fe_2O_3 and FeO, being brown when $Fe_2O_3 : FeO$ is > 0.35. Hardness of allanite increases with [Mn]. n of allanite increases with the concn. of rare-earth elements and Fe. The influence of Fe^{III} on n is $\sim$ twice that of Fe^{II}.
W. R. A.

Corundum rocks in the island of Naxos (Greek Archipelago). J. PAPASTAMATIOU (Compt. rend., 1939, **208**, 2088—2090).—A kyschtymite and *naxite*, a rock of pneumatolytic origin composed of phlogopite, corundum, and plagioclase, are described in detail. Analyses [M. RAOULT]: SiO_2 34·58, 34·32; Al_2O_3 47·29, 36·46; Fe_2O_3 0·33, 0·23; FeO 1·00, 5·94; MnO trace, 0·07; MgO 0·82, 10·07; CaO 13·42, 1·92; Na_2O 0·65, 2·70; K_2O 0·55, 5·55; H_2O+ 1·41, 2·21; H_2O- 0·23, 0·10; Cl 0·05, 0·05; F 0·04, 0·76%, respectively; TiO_2 and P_2O_5, traces.   A. J. E. W.

Direction of dispersion of anisotropy in opaque minerals. L. CAPDECOMME (Compt. rend., 1939, **208**, 2086—2088).—The direction of dispersion is determined by a simple colour test under the microscope, by reflexion of polarised light.   A. J. E. W.

Structure of syngenite. A. LASZKIEWICZ (Arch. Min. Soc. Sci. Varsovie, 1936, **12**, 8—13; Chem. Zentr., 1937, i, 1399).—Syngenite, K_2SO_4,$CaSO_4$,H_2O, has a 9·70, b 7·15, c 6·20 A., β 104°, the unit cell containing a double mol.; space-group C_{2h}^2.   A. J. E. W.

Nickel-bearing slates in the Carpathians. Z. SUJKOWSKI (Arch. Min. Soc. Sci. Varsovie, 1936, **12**, 118—143; Chem. Zentr., 1937, i, 1402).—The slates occur on the Czeremosz river, and include nodules of pyrites, millerite, and arsenopyrite, and larger masses containing Mn and carbonates, with *cayeuxite*, forming dark grey nodules, ρ 3·15—3·20, hardness $\sim$7, containing As 13, Sb 22, S 10·17, Fe 17, Ge 6, and SiO_2 15%. The red to black slates contain Ni 0·33—4·48%, with As and often Sb, but not Cu. The genesis of the deposits, which are claimed to constitute the first known occurrence of Ni in sedimentary rocks, is discussed.   A. J. E. W.

Rocks of high alkali content in Egypt. G. ANDREW (Bull. Soc. franç. Min., 1936, **59**, 338—344; Chem. Zentr., 1937, i, 1402).—A petrographic description of eruptive rocks. Cretaceous and Tertiary deposits are distinguished.   A. J. E. W.

Skolite, a new mineral of the glauconite group. K. SMULIKOWSKI (Arch. Min. Soc. Sci. Varsovie,

1936, **12**, 144—180; Chem. Zentr., 1937, i, 1401).—*Skolite*, $KH_4(Mg,Fe^{II},Ca)(Al,Fe^{III})_3Si_6O_{20},4H_2O$ (I), occurs as aggregates of parallel layers without developed crystals, giving a dark green greasy fracture; hardness 2. The strongly double-refracting crystals are probably monoclinic and cleave along (001). 4 mols. of H_2O are continuously evolved at 20—180°, (I) becoming red at 180°. 2 mols. of constitutional H_2O are evolved at $>420°$. (I) is attacked slowly by hot HCl, HNO_3, and H_2SO_4, leaving a residue of hydrated SiO_2. Glauconites occur in three groups, viz., normal (Fe_2O_3-) and Al_2O_3-glauconites, and " pholidoids," which include (I).   A. J. E. W.

Bolivian pinite from Chacaltaya. S. J. THUGUTT (Arch. Min. Soc. Sci. Varsovie, 1936, **12**, 58—63; Chem. Zentr., 1937, i, 1401).—The pinite forms pale green weakly double-refracting needles, about equal in n to $CHBr_3$; ρ 2·8430, hardness 2·5. The composition resembles that of muscovite, Ti being absent. 8% of H_2O is absorbed on exposure to the atm. The genesis of the mineral is discussed.
A. J. E. W.

Syenite rocks of the Supsa river (West Georgia). G. G. KAZAKASCHVILI and P. A. TOPURIA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 553—556).—Two syenitic neointrusions forming dykes in Middle Eocene bends of andesite breccia and flysch are described. One has a different composition in the upper and lower portions; the other consists of a transitional rock from typical syenites to teschenites, called by the authors analcime syenite.   L. J. J.

Antlerite. C. PALACHE (Amer. Min., 1939, **24**, 293—302).—New crystallographic data are recorded. X-Ray investigation [W. E. RICHMOND] gives a_0 8·22, b_0 11·97, c_0 6·02 A., V_0 592·3; space-group D_{2h}^{16}—*Pnam*. The formula is $Cu_3SO_4(OH)_4$ and the unit cell contains 4 such mols.; $\rho_{calc.}$ is 3·93 and $\rho_{obs.}$ 3·88±0·005. Antlerite (I) is the chief Cu mineral at Chuquicamata and, in some places, is formed directly from chalcocite. Brochantite, for which (I) is commonly mistaken, is rare.   L. S. T.

Large sphene crystals from San Jacinto mountains, California. R. W. WEBB (Amer. Min., 1939, **24**, 344—346).—Large crystals occurring in granodiorite are described and illustrated. The crystals usually show inclusions of andesine and quartz. Some alteration to leucoxene has occurred in some of the sphene. The origin of the sphene is discussed.
L. S. T.

Corundum in a dyke at Glen Riddle, Pennsylvania. W. H. TOMLINSON (Amer. Min., 1939, **24**, 339—343).—Evidence that corundum is not a primary pyrogenic mineral, but that it has developed through high-temp. volatile reactions on anorthite, is advanced and discussed.   L. S. T.

Gedroizite in the alkali soils. I. D. SEDLETZKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 565—568).—A synthetic *mineral* with the composition $Na_2O,Al_2O_3,3SiO_2,2H_2O$ has been obtained under alkaline conditions approaching those of alkali soils. X-Ray data are recorded. The new mineral (gedroizite) has been identified as a sp. constituent of soda alkali soils.   L. J. J.