BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

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

JULY, 1940.

Absorption of the hydrogen line 1215·7 A. by air. W. M. PRESTON (Nature, 1940, **145**, 623—624).—A discussion of the large discrepancy between the author's val. and that of Williams (A., 1940, I, 137) for the coeff. of absorption in O_2 and air. L. S. T.

Continuous absorption of light by negative hydrogen ions. H. S. W. MASSEY and D. R. BATES (Astrophys. J., 1940, **91**, 202—214).—Theoretical. L. S. T.

Second positive band system of nitrogen. R. C. PANKHURST (Proc. Physical Soc., 1940, **52**, 388—389).—New measurements, accurate to 0·1 A., for λλ of the heads of the whole system are tabulated and briefly discussed. N. M. B.

New afterglow phenomenon. J. KAPLAN (Physical Rev., 1940, [ii], **57**, 662).—A comparison of the early and late phases of a N_2 afterglow at ~20 mm. shows that the forbidden N_2 line λ 3467, corresponding with the ^2P—^4S transition, is much more intense compared with the second positive N_2 bands late in the glow than in the early part. The ratio of forbidden to allowed radiation increases unexpectedly with pressure. Results show that the spectrum of the late phase corresponds with that of the early phase of a higher-pressure afterglow, or the effect on the spectrum of the afterglow as its lifetime increases is that of an apparent increase in pressure. N. M. B.

Origin of the yellow line in twilight and the night sky luminescence. E. TÖNSBERG and L. VEGARD (Nature, 1940, **145**, 588—589).—Spectrograms of twilight in which the two components of the yellow line are separated have been obtained. This doublet is identical with the D_1D_2 doublet of Na. L. S. T.

Atmospheric layer from which the yellow line in twilight originates. L. VEGARD (Nature, 1940, **145**, 623).—Spectrograms taken in the zenith and horizontally show that the yellow line of twilight comes from a layer in the lower part of the auroral region. An extra-terrestrial origin of the Na, possibly from the sun, is indicated. L. S. T.

Absorption of the yellow line of the twilight spectrum by sodium vapour. A. KASTLER (Compt. rend., 1940, **210**, 530—532).—The intensity of the D lines in the twilight sky spectrum is reduced by passing the light through a 3-cm. cell containing Na vapour, and the lines disappear if the Na temp. is >200°. The breadth of the lines, which represents approx. the Doppler effect corresponding with the temp. interval 100—300°, is ~0·03 A. A. J. E. W.

Spark spectrum of silver. E. RASMUSSEN (Physical Rev., 1940, [ii], **57**, 840—841; cf. A., 1940, I, 137).—Intensities, λλ, wave nos., and classifications for 29 new lines obtained with a hollow cathode of pure Ag in a Ne discharge are tabulated. The strongest lines consist of doublets with separations 0·05—0·06 cm.$^{-1}$, explained as an isotopic displacement caused by the two s electrons, on the probable assumption that the origin of the new levels is the $4d^85s^2$ configuration. The enhancement of the combinations with the new levels is explained by a resonance effect of collisions of the second kind between Ne ions and Ag atoms. N. M. B.

Electrical quadrupole moment of the deuteron. Radiofrequency spectra of HD and D_2 molecules in a magnetic field. J. M. B. KELLOGG, I. I. RABI, N. F. RAMSEY, jun., and J. R. ZACHARIAS (Physical Rev., 1940, [ii], **57**, 677—695; cf. A., 1939, I, 176).—The mol. beam magnetic resonance method was applied to the study of the radiofrequency spectra, and all measurements were made in applied magnetic fields large enough to decouple the angular momentum vectors concerned. The spectrum of D_2 for the transitions $m_I = \pm 1$ consists of 6 lines as in H_2. The HD spectrum consists of a set of 9 lines in the region of the Larmor frequency of the proton, and a set of 12 lines in that of the deuteron. From the analysis of these results the existence in the deuteron of an electrical quadrupole moment, Q ($= 2{\cdot}73 \times 10^{-27}$ sq. cm.), must be assumed. The calc. spin-orbit interaction consts. are: H' (D_2) $14{\cdot}0 \pm 0{\cdot}6$; H_D' (HD) $20{\cdot}1 \pm 1$; H_P' (HD) $20{\cdot}48 \pm 0{\cdot}2$ gauss; these consts. represent the magnetic field produced by the mol. rotation at the position of a nucleus. N. M. B.

Radiofrequency spectra of atoms. Hyperfine structure and Zeeman effect in the ground state of ^{6}Li, ^{7}Li, ^{39}K, and ^{41}K. P. KUSCH, S. MILLMAN, and I. I. RABI (Physical Rev., 1940, [ii], **57**, 765—780; cf. A., 1939, I, 297).—The mol. beam magnetic resonance method is extended to the study of atoms. Transitions between the members of hyperfine structure multiplets of the ground state were observed directly and led to high-precision measurements of the hyperfine structure intervals ^{6}Li 0·007613, ^{7}Li 0·026805, ^{39}K 0·015403, and ^{41}K 0·008474 cm.$^{-1}$ These spectra were observed in external magnetic fields of 0·05—4000 gauss; the lines are completely resolved even at the low fields, and the separations derived from measurements at different fields are in good agreement. The comparative ratio of the nuclear moments of ^{7}Li and ^{6}Li as derived from the

hyperfine structure measurements is 3·9610 and the directly measured ratio 3·9601. N. M. B.

Electric quadrupole moments of ^{69}Ga and ^{71}Ga. Atomic beam study of the hyperfine structures of $^2P_{1/2}$ and $^2P_{3/2}$ states of ^{69}Ga and ^{71}Ga. N. A. RENZETTI (Physical Rev., 1940, [ii], **57**, 753—765).—An investigation by the zero-moment method of at. beams gives 6 zero-moment peaks, 3 for each isotope, of the metastable state and 2, one for each isotope, of the ground state. An equation for the hyperfine structure levels for the higher state is given and consts. are evaluated. From these the separations are ^{69}Ga 0·0362 ± 0·0007 and ^{71}Ga 0·0474 ± 0·0007 cm.$^{-1}$, and the quadrupole moments are $0·20 \times 10^{-24}$ and $0·13 \times 10^{-24}$ sq. cm., respectively. The nuclear spins are 3/2. The zero-moment peaks of the normal state give $\mu_{71}/\mu_{69} = \Delta\nu_{71}/\Delta\nu_{69} = 1·270 \pm 0·006$, and these separations are ^{69}Ga 0·0897 ± 0·0011 and ^{71}Ga 0·1139 ± 0·0019 cm.$^{-1}$ From these the nuclear moments are 2·11 and 2·69, respectively. N. M. B.

Intensity variations of bright hydrogen lines in the spectrum of γ Cassiopeiæ. T. M. LIN (Compt. rend., 1940, **210**, 561—563).—Variations in the intensities of the β, γ, δ, ε, and ζ H lines, relative to the adjacent sections of continuum, have been studied between August, 1936, and August, 1939. The observed variations are generally in the opposite sense to simultaneous changes in the mean brightness of the star. A. J. E. W.

Interpretation of nebular red-shifts. K. R. POPPER (Nature, 1940, **145**, 701).—A correction (cf. A., 1940, I, 137). L. S. T.

Continuous spectrum of *Go* type stars. D. CHALONGE and G. DÉJARDIN (Compt. rend., 1940, **210**, 558—560; cf. A., 1940, I, 184).—The intensity of the continuum has been measured in certain regions relatively free from lines (notably at 4504, 4087·5, and 3301 A.) in the stellar spectra (3000—4500 A.). The following mean colour temp. are derived: η Boötis, ζ Herculis (type *dGo*), 5900°; α Aurigæ (*gGo*), 4650° K. A. J. E. W.

***L*α satellite lines for elements Mo (42) to Ba (56).** C. A. RANDALL and L. G. PARRATT (Physical Rev., 1940, [ii], **57**, 786—791; cf. A., 1938, I, 424).—An investigation with a two-crystal vac. spectrometer of the *X*-ray satellite lines accompanying $L\alpha_{1,2}$ emission leads to integrated relative intensities of the satellite group in qual. agreement with previous photographic measurements but differing by a factor of ~6. The abrupt intensity change at $Z = 50$ further confirms the Coster–Kronig interpretation of Auger production of the initial state in satellite emission. The absence of the abrupt intensity change at $Z = 50$ of components farthest removed from the $L\alpha_1$ line is discussed. N. M. B.

Double ionisation by the Auger effect: cause of a satellite intensity anomaly for the *X*-ray diagram line $M\alpha_1$. F. R. HIRSCH, jun. (Physical Rev., 1940, [ii], **57**, 662—663).—Photographs showing the predicted anomaly (cf. A., 1936, 1169) are given and discussed. The intensity of the satellite group on the short-λ side of each $M\alpha$ line increases from $Z = 78$ (Pt) to a max. due to the Auger effect at approx. $Z = 82$ (Pb). N. M. B.

Photo-electric and optical properties of sodium and barium. R. J. MAURER (Physical Rev., 1940, [ii], **57**, 653—658).—Using polarised and unpolarised radiation, spectral distribution curves for Na and Ba were obtained. The work functions found were Na 2·28, Ba 2·48 e.v. Comparison of results with the Mitchell theory shows that it fails to account satisfactorily for the abs. photo-electric yields and for the yield ratio with radiation polarised parallel and perpendicular to the plane of incidence. N. M. B.

Secondary emission from films of silver on platinum. A. E. HASTINGS (Physical Rev., 1940, [ii], **57**, 695—699).—Total secondary emission and energy distribution of secondary electrons for films of known thickness of Ag on Pt were measured. The depth of origin of the total secondary emission as a function of primary energy, and the depth of origin of secondaries having a given energy were determined. Almost all secondaries from 20-e.v. primaries originate at <15 at. layers depth, and those from 50-e.v. primaries at <30 at. layers depth. For higher primary energies, appreciable emission comes from a depth >150 at. layers. Secondaries with energies close to that of the primaries originate at a depth small compared with that of the low-energy secondaries. N. M. B.

Theory of secondary emission from semi-conductors. E. M. ZENTER (Mém. Physique, Kiev, 1940, **8**, 167—174).—Production of secondary electrons is considered as a process of ionisation of atoms of the dielectric, affecting the whole of the semi-conducting layer of a composite cathode. The val. of the coeff. of secondary emission is determined chiefly by the no. of low-velocity electrons. R. T.

Study of the surface structure of thoriated tungsten by means of an ionic microscope. N. D. MORGULIS (Mém. Physique, Kiev, 1940, **8**, 149—153).—The Th film is shown to be discontinuous. R. T.

Theory of spark discharge. J. M. MEEK (Physical Rev., 1940, [ii], **57**, 722—728).—The breakdown of a uniform field is considered to occur by the transition of an electron avalanche from cathode to anode into a self-propagating streamer which develops from anode to cathode to form a conducting filament between the electrodes, the criterion being that a streamer will develop when the radial field about the positive space charge in an electron avalanche attains a val. of the order of the external applied field. Photo-electrons in the vicinity will then be drawn into the stem of the avalanche and will give rise to a conducting filament of plasma, and the self-propagating streamer proceeds towards the cathode. An equation for breakdown is developed and calc. breakdown potentials in air show satisfactory agreement with experiment. Deviations of the theory from Paschen's law are within the limits of experimental error. Classical theory applies as a limiting case for low vals. of pressure × gap. N. M. B.

Method of plotting electron distribution curves for the *F* layer. C. W. McLeish (Canad. J. Res., 1940, **18**, **A**, 98—103). O. D. S.

Theory of multiple scattering of electrons. J. H. Bartlett, jun. (Physical Rev., 1940, [ii], **57**, 843; cf. Goudsmit, A., 1940, I, 185).—Mathematical. A solution, subject to the boundary condition of no scattering at zero thickness, is found for Bothe's formulation of the Boltzmann equation governing the change of angular distribution with thickness of scatterer. N. M. B.

Recombination of small and large ions in gases at high pressures. W. R. Harper (Phil. Mag., 1940, [vii], **29**, 434—448).—A rigorous derivation of the recombination coeff. (α) is given for both small and large ions at high pressures. For small ions the formula reduces to that of Langevin, and α is independent of concn. for concns. $\gg$ those produced by an α-particle at 100 atm. L. J. J.

Cross-section for change of charge and ionisation by high-velocity metallic ions in hydrogen and helium. C. W. Sherwin (Physical Rev., 1940, [ii], **57**, 814—821).—The method developed allowed the primary ionisation and change of charge effects of a beam of positive ions to be studied separately. Cross-sections are tabulated for Be^+, B^+, B^{++}, C^+, C^{++}, Al^+, Al^{++}, K^+, Fe^+, Fe^{++}, Fe^{+++}, Cu^+, Cu^{++}, and Cu^{+++} moving through H_2 and He with velocities corresponding with 6000—24,000 v. accelerating potential. The energies of ions formed in the gas by primary ionisation were $\sim$10 e.v. and those of ions formed by the change of charge process were $\sim$0·1 e.v. The cross-sections depend on the type of ion and accelerating voltage, and were $<0{\cdot}01$—23×10^{-16} for H_2 and $<0{\cdot}01$—10×10^{-16} sq. cm. for He. N. M. B.

Photophoresis of small particles in a magnetic field. F. Ehrenhaft (Physical Rev., 1940, [ii], **57**, 659).—In a homogeneous vertical magnetic field, particles move, when irradiated by intense light, in the direction of the magnetic lines of force as if they were single magnetic north or south poles (magneto-photophoresis). Intense light thus apparently produces single poles on every particle, and between these "magnetrodes" a real magnetic current flows. The single-pole hypothesis explains the behaviour of these particles and the form of the corona of the sun. N. M. B.

Isotope separation by transient pressure diffusion. E. J. Hellund (Physical Rev., 1940, [ii], **57**, 743—744).—Mathematical. The separation of mols. of nearly equal masses is investigated in connexion with the Loschmidt experiment. Results are obtained by a perturbation treatment of the continuity equations for a ternary mixture. N. M. B.

At. wt. of phosphorus. Analysis of phosphorus oxybromide. O. Hönigschmid and F. Hirschbold-Wittner (Z. anorg. Chem., 1940, **243**, 355—360).—From the ratios $POBr_3$: 3Ag and $POBr_3$: 3AgBr the at. wt. of P is 30·974. F. J. G.

Measurement, in Röntgens, of the gamma radiation from radium by the free-air ionisation chamber. L. S. Taylor and G. Singer (J. Res. Nat. Bur. Stand., 1940, **24**, 247—268).—Measurements with a pressure ionisation chamber at 1—10 atm. indicate that the intensity of the γ-ray emission from Ra is 8·16 r. per mg. per hr. at a distance of 1 cm. J. W. S.

Scattering of fast electrons by nitrogen nuclei. M. D. Borisov, V. P. Brailovski and A. I. Leipunski (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 142—143).—Photographs of tracks of fast electrons from a Ra source in a cloud chamber containing N_2 show a no. of collisions with scattering through $>20°$, in approx. agreement with the no. predicted by Mott's theory (cf. A., 1929, 861). L. J. J.

Relative probability for the loss of neutrons and α-particles from an excited nucleus. J. M. Cork and J. Halpern (Physical Rev., 1940, [ii], **57**, 667—668).—Pure Fe foils were bombarded with 10-Me.v deuterons, and excitation curves were obtained for ^{54}Fe (D, α) ^{52}Mn (21 min.) and ^{54}Fe (D, n) ^{55}Co (18 hr.) (cf. A., 1939, I, 443). The radioactive yields give the relative escape probability neutron/α-particle from the same excited nucleus; at 10 Me.v. this ratio is 3 : 1. N. M. B.

Anomalous scattering of fast neutrons. M. R. MacPhail (Physical Rev., 1940, [ii], **57**, 669—676; cf. Zinn, A., 1939, I, 504).—The neutron scattering cross-sections of Al, Mg, C, Na, and N (NaN_3) were measured as a function of neutron energy in the range 2·34—2·80 Me.v. Anomalous vals. were found for Mg and Al. The anomaly is discussed on the basis of available theory, and, in the case of Mg, is quantitatively explained on the assumption of resonance in ^{25}Mg. N. M. B.

Search for a neutron–deuteron reaction. L. B. Borst and W. D. Harkins (Physical Rev., 1940, [ii], **57**, 659).—An attempt was made to prepare ^3H by bombardment of D_2O with neutrons slowed in paraffin followed by electrolysis of the D_2O and counter measurements for radioactive ^3H. Results were negative. Measurements under identical bombarding conditions of activities in Al and Ag gave a ^{28}Al activity indicating a capture cross-section of ^{27}Al for slow neutrons 300 times that of ^2D. The $^{109}Ag/^2D$ capture cross-section ratio was 10^4. The estimated cross-section of the reaction $^2D + {}^1n = {}^3H$ is 2—3×10^{-28} sq. cm. N. M. B.

Nuclear cross-sections for neutrons with 860 ke.v. energy in the region of light elements. T. Goloborodko and A. Leipunski (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 41—43).—Using a monochromatic neutron source of 860 ke.v., the nuclear scattering cross-sections of 16 light elements have been evaluated. W. R. A.

Resonance penetration of α-particles in the aluminium nucleus by a photographic method. O. Merhaut (Z. Physik, 1940, **115**, 77—96).—By means of a special photographic technique the proton yield in relation to the active α-particle energy has been examined for the reaction $^{27}_{13}Al + {}^4_2He \rightarrow {}^{*31}_{15}P \rightarrow {}^{30}_{14}Si + {}^1_1H$. L. G. G.

Collisions of α-particles with chlorine nuclei. W. HANSEN and G. A. WRENSHALL (Physical Rev., 1940, [ii], **57**, 750).—Using a large-diameter cloud chamber filled with MeCl and He, the cloud tracks of ~700,000 Th-$C + C'$ α-particles were photographed with a stereoscopic camera, and 41 forks ascribed to collisions of α-particles with Cl nuclei are analysed. The range–velocity curve is plotted and discussed. N. M. B.

Isotopic identification of induced radioactivity by bombardment of separated isotopes; 37-minute ^{38}Cl. J. W. KENNEDY and G. T. SEABORG (Physical Rev., 1940, [ii], **57**, 843—844).—The Clusius–Dickel thermal diffusion method was applied to HCl and the separated $H^{35}Cl$ fraction was bombarded with neutrons slowed by paraffin in order to establish the assignment of Cl (37 min.) which can be formed by the Cl (n, γ), Cl (d, p), and K (n, α) reactions. Results indicate that the 37-min. activity is due to ^{38}Cl formed by neutron absorption by ^{37}Cl. A 5-Me.v. group of β-particles (cf. Davidson, A., 1940, I, 141) is probably due to ^{38}Cl formed in the reaction ^{40}A (d, α) ^{38}Cl. N. M. B.

Excitation of the 455-ke.v. level of ^{7}Li by proton bombardment. C. M. HUDSON, R. G. HERB, and G. J. PLAIN (Physical Rev., 1940, [ii], **57**, 587—592; cf. A., 1937, I, 339).—Records of single and coincidence counts of γ-rays from a thin film of Li bombarded by 0·4—2·08-Me.v. protons show that above 0·85 Me.v. proton energy most of the radiation is due to excitation of the 0·455-Me.v. level of ^{7}Li without permanent capture of the proton (cf. A., 1939, I, 4). Above the 0·440-Me.v. resonance the yield of 17-Me.v. γ-radiation falls to a low approx. const. val. up to 1·6 Me.v. The absorption coeff. in Pb for the soft γ-radiation from Li was compared with that of annihilation radiation from ^{13}N. Assuming 0·511-Me.v. monochromatic radiation from ^{13}N, the energy of the soft Li radiation is 0·459 Me.v., indicating that $\not>10\%$ as many 0·28-Me.v. quanta as 0·511-Me.v. quanta are present in the radiation from ^{13}N (cf. Richardson, A., 1939, I, 295). N. M. B.

Photographic method of studying β-ray absorption by $^{32}_{15}$P. J. GOVAERTS (Nature, 1940, **145**, 624).—A photographic method for determining the intensity of β-rays emitted from an artificial radio-element is described. L. S. T.

Coincidence counting method applied to experiments in nuclear physics. J. V. DUNWORTH (Rev. Sci. Instr., 1940, **11**, 167—180).—Details are given of the methods of approaching the problem of nuclear levels and the difficulties involved are discussed. The max. source strength which can be used is inversely ∝ coincidence resolving time, and the coincidence counting method has the advantage that it can be used with very weak sources (~0·00001 millicurie). The abs. net counting efficiency of a Geiger counter for all types of radiation must be known and the method of finding this while obtaining data about nuclear level schemes is described. The coincidence method makes possible a simple and rapid determination of the total energy of disintegration of β-radioactive nuclei and therefore of the mass differences between parent and derived nuclei. T. H. G.

New type of disintegration produced by deuterons. R. S. KRISHNAN and T. E. BANKS (Nature, 1940, **145**, 777).—^{62}Cu is formed by bombarding Cu foil with 9-Me.v. deuterons. The threshold for the production of this radio-element is ~7 Me.v., and the yield increases rapidly between 8 and 9 Me.v. In the formation of ^{62}Cu the $(d–p, 2n)$ reaction is more probable than the $(d–d, n)$ reaction. L. S. T.

Existence of the ^{5}He nucleus. P. JENSEN (Z. Physik, 1940, **115**, 55—60).—Endeavours to perform the reaction ^{2}H (α, p) ^{5}He have failed. L. G. G.

Cross-section of the reaction ^{15}N (p, α) ^{12}C. M. G. HOLLOWAY and H. A. BETHE (Physical Rev., 1940, [ii], **57**, 747; cf. A., 1939, I, 592).—The determination of the cross-section of the reaction, one of the four reactions in the "C cycle" assumed to supply the energy in ordinary stars (cf. A., 1939, I, 237), is described. The val. obtained is $1·3 \times 10^{-26}$ sq. cm. at 0·36 Me.v. proton energy, in satisfactory agreement with the calc. val. $0·9 \times 10^{-26}$ sq. cm. N. M. B.

Radioactivity of the fluorine isotope of mass 20. S. C. CURRAN and J. E. STROTHERS (Proc. Camb. Phil. Soc., 1940, **36**, 252—254).—The transition ^{20}F → ^{20}Ne occurs with emission of a β-particle of max. energy 5·0 Me.v., followed by a γ-quantum of energy 2·2 Me.v. The transition from the excitation level of ^{20}Ne at 2·2 Me.v. can occur in two stages. L. J. J.

Radio-sulphur. H. LEVI (Nature, 1940, **145**, 588; cf. A., 1936, 773).—$^{35}_{16}$S has been obtained by the prolonged action of fast neutrons from Ra + Be on CCl_4 or, preferably, NaCl. The half-life period is 88±5 days. Al foil (30 mg. per sq. cm.) reduces the activity by >90%; this gives $1·2—2·0 \times 10^{5}$ e.v. as the upper limit of the β-rays from S (cf. A., 1939, I, 170). L. S. T.

Radio isotopes of chromium. T. AMAKI, T. IMORI, and A. SUGIMOTO (Physical Rev., 1940, [ii], **57**, 751—752).—Deuteron bombardment of Cr gave isotopes of half-lives 1·6 hr. and ~14 days, probably due to ^{55}Cr and ^{51}Cr, respectively. Slow neutron bombardment induced very weak activities of 2·8, 14, and 1·7 hr., probably due to impurities detected chemically and to an unidentified Cr isotope (1·7 hr.). Fast neutron bombardment induced weak activities: 3—4 hr., probably ^{50}V (3·7 hr.) produced by ^{50}Cr (n, p) ^{50}V; 14 hr., probably ^{24}Na from Al impurity as by slow neutrons; and 12 days, probably ^{51}Cr (~14 days) as by deuteron bombardment. N. M. B.

Threshold value for nuclear excitation of ^{*115}In by *X*-rays. M. I. KORSUNSKI, F. F. LANGE, and V. S. SCHPINEL (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 144).—Counter measurements show that the threshold val. for excitation of ^{*115}In by *X*-rays is <1350 kv., and probably ~1000 kv. L. J. J.

Fission of separated uranium isotopes. (A) A. O. NIER, E. T. BOOTH, J. R. DUNNING, and A. V. GROSSE. (B) K. H. KINGDON, H. C. POLLOCK, E. T. BOOTH, and J. R. DUNNING (Physical Rev.,

1940, [ii], **57**, 748, 749).—(A) From slow neutron tests of larger samples of partly separated ^{235}U and ^{234}U, the observed fissions per min. and α-particles per min. conclusively confirm previous results (cf. A., 1940, I, 187) that ^{235}U is responsible for at least 75% of slow neutron fission in unseparated U. ^{234}U is present only to 1 part in 17,000 but may contribute slightly. Fast neutron tests on ^{238}U show that it undergoes fast neutron fission only, and can account for practically all the fast neutron fission observed from unseparated U.

(B) From UCl_4 vaporised in a furnace, samples of ^{238}U and $^{234+235}U$ were prepared with a mass spectrograph. Fission tests of the separated isotopes by slow neutron bombardment show conclusively that ^{238}U is not responsible for slow neutron fission.

N. M. B.

Radioactive zirconium and niobium from uranium fission. A. V. Grosse and E. T. Booth (Physical Rev., 1940, [ii], **57**, 664—665).—Irradiation for several days of U nitrate by slow neutrons from a cyclotron gave a product from which Zr was separated, and from this a previously unknown Nb isotope was observed to grow. Decay curves give respective half-lives of 17·0±0·2 hr. and 75±3 min. Both emit β-rays of max. energy ~1 Me.v. There is evidence of a longer-life Zr (>20 days) emitting low-energy electrons (~0·25 Me.v.). N. M. B.

New radioactive isotope of masurium, $^{101}_{43}Ma$. R. Sagane, S. Kojima, G. Miyamoto, and M. Ikawa (Physical Rev., 1940, [ii], **57**, 750).—Decay curves of the chemically separated Ma and Mo fractions of Mo after bombardment with slow neutrons show a new isotope ^{101}Ma (9±1 min. emitting 1·14-Me.v. β-rays) derived from ^{101}Mo (19±1 min. emitting 1·78-Me.v. β-rays). N. M. B.

Isomeric silver and the Weizsäcker theory. L. W. Alvarez, A. C. Helmholz, and E. Nelson (Physical Rev., 1940, [ii], **57**, 660—661).—A study of 6·7-hr. Cd formed in the reaction Ag (*d*, 2*n*) Cd shows an anomalously high ratio of *L*- to *K*-conversion electrons of a 93·5-ke.v. γ-ray which are found to come from an excited state of stable Ag (40±2 sec.); this is accompanied by a weak γ-ray of ~90 ke.v. and is probably the unconverted fraction of the 93·5-ke.v. γ-ray (cf. Delsasso, A., 1939, I, 173). The *K*–*L* conversion ratio requires a multipole order of 4±0·1 for the transition between the two Ag states; the measured internal conversion coeff. of 98% requires a similar val. On this assumption the lifetime of a 93·5-ke.v. level in Ag, calc. by Weizsäcker's corr. formulæ, gives the expected val. of 30 sec. The agreement indicates that the transition is an electric rather than a magnetic 2^4 pole, so that the spin difference between the two Ag states is 4 units.

N. M. B.

Soft component of cosmic radiation in connexion with the problem of mesotron disintegration. D. V. Skobeltzyn and S. N. Vernov (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 33—36).—The hypothesis of mesotron disintegration provides no explanation of the intensity of the soft component in the bottom layers of the atm. in terms of the cascade theory. W. R. A.

Number of "decay electrons" accompanying penetrating particles. K. I. Alexeeva (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 28—32).—In travelling from the top of the atm. to sea-level some mesotrons undergo disintegration. The amount of penetrating radiation has been measured in air and after passage through filters of wood. The no. of "decay electrons" has been estimated from these data and the significance of the results is discussed.

W. R. A.

Origin of the hard component of cosmic radiation. M. Schönberg (Ann. Acad. Brasil. Sci., 1940, **12**, 33—34).—From Heitler's views of the origin of cosmic radiation (A., 1938, I, 429) it is predicted that penetrating particles created in the same process will cohere and remain associated over great distances (cf. Bhabha, *ibid.*, 291). F. R. G.

Seasonal and atmospheric temperature effect in cosmic radiation. V. F. Hess (Physical Rev., 1940, [ii], **57**, 781—785; cf. A., 1940, I, 188).—Analysis of cosmic-ray ionisation observations during 5 years at a location 2300 m. above sea-level establishes a seasonal variation with an amplitude of ±0·9%. The temp. coeff. of the cosmic radiation is ~ −0·12 in winter and ~ −0·055% per 1° in summer. Unscreened ionisation chambers and coincidence counters give smaller temp. coeffs. which become positive in summer. Hence the normal negative temp. effect cannot be explained completely on the basis of the mesotron disintegration hypothesis. N. M. B.

Barometric coefficient of extensive cosmic-ray showers. M. G. E. Cosyns (Nature, 1940, **145**, 668).—This coeff. increases rapidly with the diameter of showers up to 20 m. At sea-level above and below a thin tiled roof, an important part of the soft rays associated with 20-m. showers is produced in the roof as ordinary secondary showers. This may explain apparent anomalies in the results of former investigators. L. S. T.

Cosmic-ray intensities and cyclones. Y. Nishina, Y. Sekido, H. Simamura, and H. Arakawa (Nature, 1940, **145**, 703—704).—The effect of cyclones on these intensities has been examined. L. S. T.

Cosmic-ray intensities and air masses. Y. Nishina, Y. Sekido, H. Simamura, and H. Arakawa (Physical Rev., 1940, [ii], **57**, 663).—The possible correlation of cosmic-ray effects with atm. depressions (cf. Blackett, A., 1939, I, 55) is discussed with reference to intensities under typical air mass conditions at Tokyo. N. M. B.

Positive excess and electron component in the cosmic-ray spectrum. D. J. Hughes (Physical Rev., 1940, [ii], **57**, 592—597; cf. Jones, A., 1940, I, 189).—In view of discordant available data on the excess of positive over negative particles in the cosmic-ray spectrum, an investigation of the sea-level spectrum, with and without a Pb filter, was made. Results show, respectively, a ratio of positives to negatives of 1·21 ± 0·08 and 1·18 ± 0·08. Comparison of the two spectra shows the presence of an absorbable component (electrons) in the energy region 2—8 × 10^8 e.v., but no absorbable particles of higher energy. N. M. B.

System of units for nuclear and cosmic-ray phenomena. B. Rossi (Physical Rev., 1940, [ii], **57**, 660).—An attempt to adopt a consistent system of units for nuclear or cosmic-ray phenomena and for macroscopic physics. N. M. B.

Interpretation of neutron measurements in cosmic radiation. H. A. Bethe, S. A. Korff, and G. Placzek (Physical Rev., 1940, [ii], **57**, 573—587).—Study of the factors influencing the energy distribution of neutrons in the atm. shows that diffusion equilibrium exists except for ~1 m. of H_2O at the top and 1 m. above ground. An equation is given for the energy distribution below 100 ke.v., which contains few thermal neutrons. As an example of ground influence, the neutron distribution in the air above a H_2O surface is calc. Experimental arrangements are discussed; a detector such as a BF_3 counter measures essentially the neutron density, and the evaluation of experiments using hydrogenic material to slow down the neutrons is considered. From these two types of experiments concordant results for neutron production are obtained. N. M. B.

Energy loss of electrons in carbon and the decay of the mesotron. H. R. Crane, N. L. Oleson, and K. T. Chao (Physical Rev., 1940, [ii], **57**, 664; cf. Fermi, A., 1940, I, 91).—The energy loss in graphite for 10-Me.v. electrons was measured. The net corr. val. due to collisions alone is 1·69 ± 0·08 Me.v. per g. per sq. cm. (cf. A., 1937, I, 594). Vals. for the collision loss calc. by the Bloch–Fermi formulæ for the dielectric const. effect are given. The experimental loss val. accords best with ϵ 1·05—1·5. N. M. B.

Average number of electrons accompanying a cosmic-ray meson due to collisions of the meson with atomic electrons. E. J. Williams (Proc. Camb. Phil. Soc., 1940, **36**, 183—192).—The average no. of electrons accompanying a meson, due to collisions with at. electrons, is calc. as 0·36 for air and 0·39 for Pb. The no. of electrons with energy > 3 Me.v. is 0·12—0·16 for air, 0·10—0·15 for Cu, and 0·08—0·13 for Pb, assuming in each case a pure Coulomb interaction. L. J. J.

Shower production by mesotrons in different materials. W. F. G. Swann and W. E. Ramsey (Physical Rev., 1940, [ii], **57**, 749).—Using the arrangement previously described (cf. A., 1939, I, 547), measurements for Pb are extended to Sn, Fe, and Mg. Results are plotted and discussed. N. M. B.

Hypothesis of the existence of contraterrene matter. V. Rojansky (Astrophys. J., 1940, **91**, 257—260).—The existence of atoms ("contraterrene") consisting of negatively charged nuclei surrounded by positrons is discussed. Identification should be possible through annihilation effects resulting from their collisions with ordinary atoms. L. S. T.

Metastability of hydrogen and helium levels. G. Breit and E. Teller (Astrophys. J., 1940, **91**, 215—238). L. S. T.

Theory of nuclear forces. R. Peierls (Nature, 1940, **145**, 687—690).—A summary. L. S. T.

Type of elementary particle for which the wave-functions satisfy the Klein-Gordon equation. A. Proca (Compt. rend., 1940, **210**, 563—564).—Theoretical. A. J. E. W.

Possibility of existence of a second series of "rare earths" in the place reserved for actinium in the periodic table. G. E. Villar (Ann. Acad. Brasil. Sci., 1940, **12**, 51—57).—From the electronic structure of Ac, Th, Pa, and U it is concluded that these, with 11 succeeding trans-U elements, form a group analogous with the rare-earth elements. This view is supported by the supposed properties of the disintegration product of U obtained by Curie and Savitch (A., 1938, I, 291; cf. A., 1939, I, 116). F. R. G.

Mass centre in relativity. M. Born and K. Fuchs (Nature, 1940, **145**, 587).—A relativistic formulation of the theorem of mass centre for free particles is presented. L. S. T.

Mass of the universe. (A) C. M. Beadnell. (B) (Sir) A. S. Eddington (Nature, 1940, **145**, 549). L. S. T.

Binding energy of ^{7}Li. K. G. Carroll (Physical Rev., 1940, [ii], **57**, 791—794).—Mathematical. There is a large discrepancy between the known binding energy and that calc. on a first-order Hartree method with reasonable nuclear consts. It is shown that on including higher orders in the perturbation treatment about half the discrepancy remains and may be attributed to the exchange forces assumed. N. M. B.

Dynamics of complex fission. R. D. Present and J. K. Knipp (Physical Rev., 1940, [ii], **57**, 751).—Mathematical. A preliminary report of an investigation of the large-amplitude distortions of a nucleus undergoing fission. An expression for the potential energy of distortion is given and detailed conclusions are discussed. N. M. B.

Theory of electric charge and the quantum theory. II. H. T. Flint (Phil. Mag., 1940, [vii], **29**, 417—433).—Mathematical. The author's earlier treatment (A., 1938, I, 596) is extended to a five-dimensional continuum. L. J. J.

Classical theory of electrons. H. J. Bhabha (Proc. Indian Acad. Sci., 1939, **10**, **A**, 324—332).—Theoretical. W. R. A.

Hydrodynamics of an electronic gas. D. I. Blochintzev (Mém. Physique, Kiev, 1940, **8**, 143—147).—Mathematical. R. T.

Degeneracy in quantum mechanics. J. M. Jauch and E. L. Hill (Physical Rev., 1940, [ii], **57**, 641—645).—Mathematical. N. M. B.

Connexion between the spin and statistics of elementary particles. J. S. de Wet (Physical Rev., 1940, [ii], **57**, 646—652).—Mathematical. N. M. B.

Generalised wave equation and classical mesodynamics. D. Ivanenko and A. Sokolov (Compt. rend. Acad Sci. U.R.S.S., 1940, **26**, 37—40).—Mathematical. W. R. A.

Structure of the OD bands of heavy water. K. R. RAO and M. G. SASTRY (Nature, 1940, **145**, 778).—The bands at 2872 and 2916 A. have been measured using discharges through the vapour of 99·6% D_2O. They correspond with the (1, 0) and (2, 1) bands of OH with heads at 2811 and 2875 A. due to $^2\Sigma^+ \rightarrow {}^2\Pi_{inv.}$. The consts. for the 2872 A. band are recorded. L. S. T.

Dissociation schemes for diatomic hydrides and deuterides. II. L. GERÖ and R. SCHMID (Z. Physik, 1940, **115**, 47—54; cf. A., 1939, I, 183).—Theoretical. L. G. G.

Tail bands of the Deslandres-d'Azambuja system of the C_2 molecule. G. HERZBERG and R. B. SUTTON (Canad. J. Res., 1940, **18, A**, 74—82).—The investigation of the C_2 spectrum has been continued (cf. A., 1937, I, 595). Analysis of new bands shows that they are tail bands of the Deslandres-d'Azambuja system. Improved vals. for the rotational and vibrational consts. of the upper and lower states $^1\Pi_g$ and $^1\Pi_u$ have been obtained. The energy difference between the $^1\Pi_u$ state and the $^3\Pi_u$ ground state is 1·7 e.v., in fair agreement with Mulliken's theoretical estimate of 2·1 e.v. C. R. H.

Negative bands of the heavy nitrogen molecules. R. W. WOOD and G. H. DIEKE (J. Chem. Physics, 1940, **8**, 351—361).—A detailed account of work already noted (A., 1939, I, 1, 49). It is confirmed that the spin of ^{15}N is $\frac{1}{2}$. W. R. A.

Rotational analysis of the band spectrum of boron monobromide. E. MIESCHER and E. ROSENTHALER (Nature, 1940, **145**, 624).—Consts. for the BBr mol. are given. L. S. T.

Spectroscopic evidence for the B_2 molecule. A. E. DOUGLAS and G. HERZBERG (Physical Rev., 1940, [ii], **57**, 752).—An attempt to observe a B_2 spectrum in a discharge through He at ~10 mm. pressure containing a trace of BCl_3 shows a system of new bands at 3300—3170 A. having a simple fine structure (*P* and *R* branches only). The emitter is shown to be the B_2 mol. and its existence is established for the first time. The main bands are due to $^{11}B^{11}B$ and the weaker bands to $^{11}B^{10}B$. A preliminary vibrational analysis yields an expression for the band heads; consts. are found from rotational analysis and give internuclear distances 1·628 and 1·595 A. for r_0' and r_0''. The spin of the ^{11}B nucleus is probably 3/2. The bands probably represent a $^3\Sigma_u^- \rightarrow {}^3\Sigma_g^-$ transition. When N_2 was added to the discharge new band systems around 3600 and 3225 A. were found, the former due definitely, and the latter probably, to BN. When H_2 was added two new electronic transitions of BH were found at 3415 and 3100 A. N. M. B.

Absorption variations of a selenium-tinted glass as a function of temperature. J. ESCHER-DESRIVIÈRES and Y. GODRON (Compt. rend., 1940, **210**, 215—217).—Transmission curves (5700—6600 A.) for orange-red Se-tinted glasses at 10—360° are given. Increase of temp. from 10° to 100° and 300° displaces the curves 100 and 400 A., respectively, towards higher λλ. The curves are approx. parallel at 10—150°, but become deformed at higher temp., with loss of transparency. The absorption changes appreciably over the normal range of room temp. A. J. E. W.

Band spectrum of SnTe in emission. R. F. BARROW (Proc. Physical Soc., 1940, **52**, 380—387; cf. A., 1939, I, 178).—Using a heavy-current uncondensed discharge through a mixture of Sn, Te, and Al in a Si discharge tube, the band spectrum of SnTe was photographed in emission. In the region λλ 3575—4235 ~45 bands were observed and measured, and 26 of these are assigned to a main system for the band heads of which an equation is found. Bands on the short-λ side of the system appear to belong to an incompletely developed system. Heads increasingly distant from their respective system-origins become increasingly diffuse owing to the vibrational isotope effect. Available results for the analogous PbO, SnO, PbSe, PbTe, SnSe, SnS, and PbS are reviewed (cf. Walker, A., 1938, I, 116). N. M. B.

Band spectrum of antimony chloride. W. F. C. FERGUSON and I. HUDES (Physical Rev., 1940, [ii], **57**, 705—707; cf. A., 1938, I, 116).—A band spectrum in the region λλ 4200—5600, attributed to SbCl, was excited by introducing $SbCl_3$ into active N, and consists of bands showing marked progressions and degraded towards the red. They are classified into two sub-systems and vibrational analysis gives expressions for the wave nos. of the heads of 41 bands. The Cl isotope effect appears in 13 bands. Introduction of $AsCl_3$ vapour into active N failed to produce a spectrum of AsCl. N. M. B.

Spectra of lead hydride and tin hydride in the near infra-red. W. W. WATSON and R. SIMON (Physical Rev., 1940, [ii], **57**, 708—709; cf. A., 1939, I, 118).—Corr. PbH band origins and assignments of the lines of 4 additional bands in the photographic infra-red to 9105 A. are tabulated, and from analyses of these bands revised calculations of energy consts. are obtained. An isolated weak PbH band is found at 3815 A. Additional SnH bands in the red produced in the high-pressure arc are briefly discussed (cf. *ibid.*, 238). N. M. B.

Interpretation of the long-wave infra-red emission (300 μ.) of the mercury high-pressure arc as temperature radiation. W. DAHLKE (Z. Physik, 1940, **115**, 1—10; cf. A., 1940, I, 50).—Continuation of earlier work. An equation is developed for the intensity of emission. L. G. G.

Atmospheric absorption of infra-red solar radiation at the Lowell observatory. II. Spectral interval 5·5—8 μ. A. ADEL and C. O. LAMPLAND (Astrophys. J., 1940, **91**, 1—7; cf. A., 1939, I, 239).—The intensity variations in the telluric spectrum between 5·5 and 8 μ. are large; they are regarded empirically as functions of atm. H_2O-vapour content. L. S. T.

Colours of 1332 B stars. J. STEBBINS, C. M. HUFFER, and A. E. WHITFORD (Astrophys. J., 1940, **91**, 20—50).—The colours of 1332 stars of spectral types B, O, cB, and cA, measured with a photoelectric cell, are tabulated. L. S. T.

CH bands in comet spectra. J. DUFAY (Astrophys. J., 1940, **91**, 91—102).—The presence of the 4300 A. band, and probably that of the 3900 A. band, is confirmed. L. S. T.

Spectral energy curve of the sun in the ultra-violet. E. PETTIT (Astrophys. J., 1940, **91**, 159—185).—The O_3 content of the atm. above Mt. Wilson is ~0·1 cm. λλ and line intensities in the ultra-violet O_3 band are recorded; the line intensities are too low to be distinguishable in the solar spectrum. L. S. T.

Infra-red spectra and the structure of molecules. W. H. J. CHILDS and H. A. JAHN (Nature, 1940, **145**, 646—649).—A review. L. S. T.

Infra-red absorption. X. Infra-red absorption of hydrogen fluoride in the vapour state and in solution in an inert solvent. A. M. BUSWELL, R. L. MAYCOCK, and W. H. RODEBUSH (J. Chem. Physics, 1940, **8**, 362—365).—In agreement with the data of Imes (cf. A., 1921, ii, 4), HF in the vapour state exhibits two bands with centres at 2·59 and 2·47 μ. due to single mols., and stronger absorption at 2·85 and 2·97 μ. due to H-bonded polymerides. In CCl_4 (0·0045—0·016 mol. HF per l.) very little absorption due to association is encountered and this is difficult to explain. The spectrum of a thin crystal of KHF_2 is recorded and discussed. W. R. A.

Vibration spectra of azoimide, methyl azide, and methyl *iso*cyanate. Thermodynamic functions of azoimide. E. H. EYSTER and R. H. GILLETTE (J. Chem. Physics, 1940, **8**, 369—377).—The infra-red spectra of gaseous HN_3, MeN_3, and MeNCO between 2 and 20 μ. have been investigated. Results are compared with existing Raman data and with data for MeNC. Since these mols. are structurally similar the assignment of observed bands to fundamental modes of vibration is possible for all except the Me torsional frequency in Me compounds. From the similarity of the spectra of MeN_3 and MeNCO it is concluded that the $\cdot N_3$ and ·NCO groups are linear and that the Me is attached at an angle to the linear axis of the $\cdot N_3$ or ·NCO. Resonating structures are given and discussed. Vals. of S, C_p, and $-(G^0 - H_0^0)/T$ from 100° to 600° K. have been evaluated from the fundamental νν and moments of inertia of HN_3 on the basis of a rigid rotator–harmonic oscillator. The standard free energy and equilibrium const. for the reactions $\frac{1}{2}H_2 + \frac{3}{2}N_2 = HN_3$ and $\frac{1}{3}NH_3 + \frac{4}{3}N_2 = HN_3$ are given from 298·1° to 600° K. W. R. A.

Infra-red spectra. Determination of C–H frequencies (~3000 cm.$^{-1}$) in paraffins and olefines; observations on "polythenes." J. J. FOX and A. E. MARTIN (Proc. Roy. Soc., 1940, **A**, **175**, 208—233).—The absorption spectra of some 20 hydrocarbons have been studied in the region 2·6—3·8 μ. The valency vibrations characteristic of the following mol. groups were investigated: ⩾C–H and =CH_2 in unsaturated hydrocarbons; >CH_2 group in long-chain paraffins; Me in saturated and unsaturated hydrocarbons; ⩾C–H in saturated hydrocarbons. Two samples of a polythene showed bands characteristic of the Me group, the spectra being similar to those of normal long-chain paraffins. G. D. P.

Chemical elementary processes in light emission of sulphide phosphors. R. SCHENCK (Z. Elektrochem., 1940, **46**, 27—38).—An exhaustive review and discussion of previous work, directed towards the correlation of optical and other physical data with the characteristics of the relevant chemical equilibria. A. J. E. W.

Luminescence spectra of phosphors activated with silver. A. S. TOPORETZ (Mém. Physique, Kiev, 1940, **8**, 161—166).—The luminescence spectra of the phosphors MX–Ag consist of two bands (245—260 and 360—390 mμ.) when M = Na, and one band (275—290 mμ.) when M = K (X = Cl, Br, I). The mechanism of luminescence is discussed. R. T.

Luminescence of pure radium and barium compounds. D. H. KABAKJIAN (Physical Rev., 1940, [ii], **57**, 700—705; cf. A., 1937, I, 220).—Carefully purified $RaBr_2$, $RaCl_2$, $RaSO_4$, $BaBr_2$, $BaCl_2$, and $BaSO_4$ excited by α-, β-, and γ-rays show a faint luminescence at room temp. When heated and then cooled they show, with increase of heat-treatment temp., a continuous increase in luminescence to a max. Heat-treatment at higher temp. diminishes the brightness. The temp. of max. brightness (which may be several hundred times the initial brightness before heating) is not directly related to m.p. The removal of the second H_2O in $BaBr_2,2H_2O$, by heating at 150—200°, caused a decrease in luminescence followed by a sharp rise. No abrupt intensity changes, such as might be due to changes in cryst. form, were detected. N. M. B.

Extinction of phosphorescence of acetophenone at the temperature of liquid air. B. A. PIATNITZKI (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 220—221).—The extinction follows the law $I = I_0e^{-\alpha t}$, where t is measured in sec. and the average val. of α is 0·6. L. S. T.

Raman effect and crystal symmetry. B. D. SAKSENA (Proc. Indian Acad. Sci., 1940, **11**, **A**, 229—245).—Selection rules for crystals of different symmetries and the polarisation characteristics of the Raman lines for different crystal orientations are discussed. Results are compared with experimental data on $NaNO_3$. W. R. A.

Hindered rotation. I. Configuration of the *cyclo*hexane molecule. A. LANGSETH and B. BAK. **II. Hindered rotation about the C–C single bond in tetrachloroethane.** A. LANGSETH and H. J. BERNSTEIN. **III. Qualitative nature of the interactions hindering internal rotation.** A. LANGSETH, H. J. BERNSTEIN, and B. BAK (J. Chem. Physics, 1940, **8**, 403—409, 410—415, 415—418).—I. Raman spectra of the *cyclo*hexanes, C_6H_{12}, $C_6H_{11}D$, and C_6D_{12} have been examined and intensities and state of polarisation of the lines are given. $C_6H_{11}D$ was prepared from bromo*cyclo*hexane by a Grignard reaction under controlled conditions which prevented formation of *cyclo*-hexane and -hexene. C_6D_{12}, b.p. 77·8—78·0°/760 mm., was prepared by deuterating C_6D_6 with D_2 at 180° in the presence of a Ni catalyst and treating the equilibrium mixture with Br and Fe powder in the dark; C_6D_6 is rapidly brominated but C_6D_{12} is scarcely attacked. The possible models,

D_{6h}, D_{3d}, D_2, C_{2v}, and C_2, and their spectroscopic characteristics and selection rules are discussed. The observed spectrum of C_6D_{12} supports the D_{6h} model, and so do the vals. of the ratio of isotopic frequencies calc. from Teller's product rule. The symmetry of $C_6H_{11}D$ is C_s. Observed νν (<1500 cm.$^{-1}$) have been assigned. There is no evidence of a ^{13}C isotope line; a reason for this is given. The influence of restricted free rotation about the C–C linking on the stability of the mol. is discussed, and it is shown that restricted rotation stabilises the D_{6h} configuration in which the H atoms are in "opposed" positions.

II. Owing to restricted free rotation $(CHCl_2)_2$ might consist of rotational isomerides having a *cis*-form (C_{2v}), a *trans*-form (C_{2h}), or intermediate forms with C_2 symmetry. The potential energy curves are discussed. The Raman frequencies, and their intensities, have been measured at various temp. for $C_2H_2Cl_4$ and $C_2D_2Cl_4$, which was prepared by bubbling C_2D_2 and Cl_2 into a flask containing CCl_4 and finely divided $AlCl_3$. $(CHCl_2)_2$ is an equilibrium mixture of the *cis*- (C_{2v}) -form and a C_2 form, the potential energy of which is 1100 g.-cal. per mol. > that of the more stable C_{2v} form. There appears, therefore, to be an interaction, acting in the opposite sense to dipole interaction, and ensuring that atoms on the two C atoms are in "opposed" positions.

III. From the above work the most stable configurations are those in which the atoms are in "opposed" positions. The most important contributions to potential barriers restricting free rotation are (i) dipole and steric effects which stabilise "staggered" forms and (ii) interactions stabilising "opposed" forms. A physical picture based on the symmetry properties of the mol. and ideas associated with overlapping of wave functions is presented to account for the interactions acting through the C–C linking and tending to stabilise "opposed" configurations. C_2H_6, $(CMe{:})_2$, C_3H_6, PhMe, $C_2H_4Cl_2$, $C_2H_4Br_2$, and $(CHCl)_2$ are discussed. W. R. A.

Hindered rotation in $CH_2D{\cdot}CH_2Br$. A. Langseth, H. J. Bernstein, and B. Bak (J. Chem. Physics, 1940, **8**, 430—431; cf. preceding abstract).—$CH_2D{\cdot}CH_2Br$ can be predicted to be an equilibrium mixture of two rotational isomerides, a *cis*-form in which D is opposed to Br, and two spectroscopically identical *trans*-forms in which D opposes either of the H in $\cdot CH_2Br$. The intensity ratio of Raman lines of the *trans*- and *cis*-forms should ≃ 2. A symmetrical vibration in a *cis*-form is shown to have a lower frequency than the corresponding vibration in a *trans*-form. Thus the Raman spectrum of $CH_2D{\cdot}CH_2Br$ should consist of pairs of lines in which, for symmetrical vibrations, the higher frequency member should be approx. twice as intense as the lower frequency member. The spectra of EtBr and C_2H_4DBr (for the C–Br stretching vibration) are compared, and data agree with theoretical predictions. The D_{3h} configuration of C_2H_6 is substantiated. W. R. A.

Raman spectra of phosphorus methyl and arsenic methyl and the force constant of the methyl compounds of the fifth group elements. E. J. Rosenbaum, (Miss) D. J. Rubin, and C. R. Sandberg (J. Chem. Physics, 1940, **8**, 366—368).—PMe_3 and $AsMe_3$ give 15 and 12 Raman lines respectively. Spectra of XMe_3 mols. (X = N, P, As, Sb, Bi) are compared. The appearance of only two very strong low-frequency lines in $SbMe_3$ and $BiMe_3$ is attributed to an accidental degeneracy produced by the relatively high at. wt. of the apical atom of the pyramidal (C_{3v}) structure and to the val. of the apical angle. Using a two-const. valency force potential function νν and force consts. have been evaluated. Calc. νν are in good agreement with observed vals. Discrepancies between the data obtained for $AsMe_3$ and those given by Feher and Kolb (A., 1940, I, 57) are briefly discussed. W. R. A.

Raman spectrum of glycerol. B. D. Saksena (Proc. Indian Acad. Sci., 1939, **10**, **A**, 333—340).—By an improved distillation method glycerol, relatively free from fluorescence, has been obtained and gives 21 Raman displacements and an O–H band. Twelve lines are polarised and 3 depolarised. Assignments of the lines to groups in the mol. are made. The changes in position and intensity of the lines on dilution with H_2O are discussed. W. R. A.

Raman spectra of some carboxylic acids. K. S. Bai (Proc. Indian Acad. Sci., 1940, **11**, **A**, 212—228).—Raman spectra of $Pr^{\beta}CO_2H$ (I) at 35° and 145°, BzOH (II) (molten and solid), lactic acid (III) (liquid), Et lactate (liquid), and cinnamic acid (IV) (molten and solid) are recorded and compared with existing data. For (I) a displacement of 1650 cm.$^{-1}$, found alone at 35°, remains unaltered at 145° and a new displacement of ~1720 cm.$^{-1}$ appears. The smaller displacement is attributed to the C:O group in the dimeride and the larger to the C:O in the monomeride. On this basis it is concluded that (II) and (IV) as solids are principally in the dimeric state but that on melting some monomerides are formed. (III) is almost completely monomeric. The C:O frequency in solid (II) and (IV) is < that in the molten acids, indicating stronger H-bonding. Increased temp. causes ionisation as well as depolymerisation of (I) and this is indicated by the increased intensity of the displacements 790, 1361, and 1532 cm.$^{-1}$ Changes in the location and intensities of lines of (IV) are attributed to *cis–trans* isomerism; (IV) in the solid state is predominantly *trans* but almost completely *cis* in the liquid state. W. R. A.

Mean life of electronically activated nitrogen. R. Audubert and C. Racz (Compt. rend., 1940, **210**, 217—219).—Photon counter measurements during intermittent electrolysis of 0·5N-NaN_3, synchronised with the rotation of a sector between counter and anode, show that metastable mols. with a mean life of $2{\cdot}5 \pm 0{\cdot}2 \times 10^{-3}$ sec., probably of electronically activated N_2, are formed during the electrolysis. A. J. E. W.

Dielectric constants of some oxides, hydroxides, and oxide hydrates. O. Glemser (Z. Elektrochem., 1939, **45**, 865—870).—ε obtained by an immersion method is given for hydroxides of Al, Be, Mg, and Zn, various preps. of their oxides, and related minerals. Synthetic, finely-divided products have much higher ε than corresponding minerals,

owing to greater mobility of the at. groups, and a correspondingly greater displacement polarisation. Curves relating ϵ to the temp. of dehydration ($\theta \not> 1300°$) are also given for amorphous hydrated Fe_2O_3 and α- and γ-FeO_2H; an abnormal rise in ϵ, commencing at high and variable θ vals., is attributed to formation of Fe_3O_4. A. J. E. W.

Dielectric constant, power factor, and resistivity of marble. A. H. SCOTT (J. Res. Nat. Bur. Stand., 1940, **24**, 235—240).—The dielectric const. (ϵ) and power factor (f) at 1000 cycles per sec. and the sp. resistance (r) of various samples of marble, dry, and after 30 days' exposure to air of 85% R.H., have been determined. ϵ and f have also been determined for certain marbles at various frequencies. Coloured marbles have higher ϵ and f than white marbles, but r and effects of H_2O are variable. Even for dry marble ϵ varies widely for different samples; a mean val. is 9. J. W. S.

Dielectric polarisation in solution. I. Failure of the Clausius–Mosotti equation. W. H. RODEBUSH and C. R. EDDY (J. Chem. Physics, 1940, **8**, 424—428).—Whilst infra-red absorption spectra show the presence of H bonds, dielectric polarisation appears to give the most exact information regarding the degree of polymerisation and its variation with concn. Measurement of the dielectric polarisation of alcohols in non-polar solvents has yielded data which cannot be interpreted by the Debye–Clausius–Mosotti (D–C–M) method, particularly in dil. solutions. Consideration of existing data for solutions of non-associated polar solutes in non-polar solvents gives erroneous and misleading conclusions regarding the polarisation of the solute. The main defect of the D–C–M method is that it assumes that the permanent moment is a const. of the mol. irrespective of environment. The Clausius–Mosotti theory appears to contain two fundamental errors, (i) assumption of an unvarying permanent μ, (ii) the inclusion of the reaction field in the total orienting field acting on the mol. These two effects cause deviations in opposite directions. The modifications of Onsager (A., 1936, 1182) are discussed and the limitations of his theory are indicated. A term, called the apparent molal polarisability, $(\epsilon - 1)V/4\pi$, is evaluated for several mols. and is a linear function of concn. The slope of this plot gives the partial molal polarisation which becomes a significant quantity by Onsager's theory. By means of this theory good agreement between observed and calc. vals for solutions is obtained, and it is possible to calculate the moment in the vapour state. When agreement is obtained using D–C–M methods it is considered to be fortuitous. W. R. A.

Behaviour of polar molecules in solid paraffin wax. D. R. PELMORE and E. L. SIMONS (Proc. Roy. Soc., 1940, **A**, **175**, 253—254; cf. A., 1939, I, 181).—The relaxation time of amyl stearate embedded in paraffin wax was investigated under the conditions previously used for a series of esters with an even no. of C atoms. The results indicate that there is no marked difference between the behaviour of an odd ester and that of its two even neighbours. G. D. P.

Present state of valency theory. L. E. SUTTON (J.C.S., 1940, 544—553).—A lecture. F. J. G.

Crystal chemistry of intermetallic compounds of the AB_2 type (Laves phases). G. E. R. SCHULZE (Z. Elektrochem., 1939, **45**, 849—865).—The three structures (typified by $MgCu_2$, $MgZn_2$, and $MgNi_2$) which occur in Laves phases are "homo-otectic," *i.e.*, they involve exactly similar co-ordination relationships, but differ in symmetry. Their lattices may be regarded as interlaced structures of the component A and B lattices. The A atoms have a physically active co-ordination no. of 16, although each A has only 12 immediate neighbours; the B atoms are 6-co-ordinate. The ideal radius quotient, $A : B$, is 1·225 (observed vals., 1·11—1·38). The interat. distances are slightly $<$ those in pure A and B. The B atoms are slightly deformed, and the B–B linkings are stronger than the A–A linkings; the B lattice in AB_2 has also a higher binding energy than in pure B, owing to the participation of electrons in the penultimate shell. In general, a Laves phase occurs when A has a strong tendency to form metallic linkings with B, and B has an incomplete penultimate electron shell and a radius $\sim$20% $<$ that of A. Other lattice types formed by similar mechanisms are unknown. The application of the results to ternary Laves phases is briefly discussed. A. J. E. W.

Simple method for calculating moments of inertia. J. O. HIRSCHFELDER (J. Chem. Physics, 1940, **8**, 431).—A utilisation of Crawford's method of calculating generalised moments of inertia (A., 1940, I, 198). W. R. A.

Calculations on the energies of hydrocarbons. G. J. KYNCH, E. H. LLOYD, and W. G. PENNEY (Nature, 1940, **145**, 777—778).—New calculations on the energies, internuclear distances, and vibration frequencies of C_6H_6 and butadiene mols. are recorded in both the ground and excited states. The heat of sublimation computed for C is 170±10 kg.-cal. per g.-mol. L. S. T.

Energy in unsaturated hydrocarbon molecules. C. A. COULSON (Proc. Camb. Phil. Soc., 1940, **36**, 201—203).—Mathematical. The mol. orbital method is applied to the calculation of the energy of the mobile electrons in unsaturated hydrocarbon mols. L. J. J.

Molecular orbitals. C. A. COULSON and G. S. RUSHBROOKE (Proc. Camb. Phil. Soc., 1940, **36**, 193—200).—Conditions under which the mol. orbital method gives a self-consistent field in the case of mobile electrons in unsaturated hydrocarbon mols. are analysed. L. J. J.

Bonding powers of groups of *d* electrons. W. G. PENNEY (Trans. Faraday Soc., 1940, **36**, 627—633).—The binding energies (W) of hydrated ions to their H_2O clusters, when plotted against at. no., fall on a smooth curve for $Ca^{\cdot\cdot}$, $Mn^{\cdot\cdot}$, and $Zn^{\cdot\cdot}$, whilst for ions of intermediate at. no. they do not. A theory is outlined which, by taking account of differences in the energies of the most stable orientations of groups of electrons d^0—d^{10} and using these to correct the vals. of W, enables the intermediate ions to be brought more into line with $Ca^{\cdot\cdot}$, $Mn^{\cdot\cdot}$, and $Zn^{\cdot\cdot}$. It also

permits an approx. estimate of the heats of vaporisation of the metals. F. L. U.

Electronic absorption spectra in solution with special reference to the continuous absorption of the halogens. N. S. BAYLISS and A. L. G. REES (J. Chem. Physics, 1940, **8**, 377—381).—On the basis of the cage theory of liquids the potential function which must be added to the $U(r)$ curves of gaseous mols. to give the $U(r)$ curves of dissolved mols. has been determined. The slight displacement of the absorption max. in halogens dissolved in non-associated solvents and the change in symmetry of the absorption curve are explained. In associated solvents the max. is greatly displaced due to compression of solute mols. by the quasi-cryst. structure of the solvent. The conditions under which band absorption persists in solution are discussed in terms of relaxation time and r_e vals. of normal and excited states. W. R. A.

Electronic absorption spectra in solution. A. L. G. REES (J. Chem. Physics, 1940, **8**, 429—430; cf. preceding abstract).—The addition of a potential barrier to the $U(r)$ curves of the ground and excited electronic levels is proposed to explain solvent effects on absorption spectra. The part of the function which is determined by the cage of solvent mols. about the absorbing mol. can be evaluated from the work necessary to increase the internal surface area of the solvent cage so that the mol. may be accommodated when nuclear separation is increased during a vibration. Br in $CHCl_3$ and Br and I in H_2O are considered. W. R. A.

Correlation of upper electronic states of homologous molecules. R. F. BARROW (Trans. Faraday Soc., 1940, **36**, 624—625).—Attention is drawn to the linear relation existing between $(I_1I_2)^{\frac{1}{2}}$ (I = at. ionisation potential) and the electronic energy for the alkali-metal mols.; its significance is briefly discussed. F. L. U.

Intensities in molecular electronic spectra. X. Calculations on mixed-halogen, hydrogen halide, alkyl halide, and hydroxyl spectra. R. S. MULLIKEN (J. Chem. Physics, 1940, **8**, 382—395).—The dipole strengths for certain perpendicular type transitions $N \rightarrow Q$ have been calc. by the *LCAO* and *AO* approximations. For bromides good agreement with experimental vals. is obtained. Iodides give anomalously low strengths for the $N \rightarrow {}^3\Pi_1$ and $N \rightarrow {}^1\Pi$ parts of the intensity and high strength for $N \rightarrow {}^3\Pi_0{}^+$. The comparison between calc. and observed vals. confirms that ultra-violet continua of H and alkyl halides are $N \rightarrow Q$ transitions. The dipole strength of the ${}^2\Sigma \rightarrow {}^2\Pi$ transition in OH has been calc. A general equation for the $N \rightarrow Q$ dipole strength in AX or OH is derived for any degree of ionicity and polarity. Intensity is not very sensitive to polarity. The relationship between the magnitudes of overlapping and dipole strength integrals and (*a*) mol. stability, (*b*) principal valency quantum no., is discussed. The integrals for mols. containing Cl, Br, or I are $\gg$ for those containing F. They are also larger for HX mols. than for X_2 mols. (X = halogen). W. R. A.

Resonance in the chloroacetic acids. H. O. JENKINS (Nature, 1940, **145**, 625).—The inductive effect of the substituted dipoles does not account completely for the increasing vals. of K for $CH_2Cl{\cdot}CO_2H$, $CHCl_2{\cdot}CO_2H$ (I), and $CCl_3{\cdot}CO_2H$ (II). Resonance, which stabilises preferentially the ionic forms, is suggested as the factor strongly enhancing the K of (I) and (II). Four and twelve conjugated structures contribute to the actual state of the ion in (I) and (II), respectively. A linear relation exists between log K and log n for the three acids with n = 2, 6, and 14, respectively. L. S. T.

Theory of vibrations of sodium chloride lattice. E. W. KELLERMANN (Phil. Trans., 1940, **238**, 513—548).—Ewald's treatment applied to the Born frequency equation for vibrating polar crystals enables a quickly convergent form of the consts. of the equation to be given. The general formulæ for the coeffs. have been worked out and applied to the case of NaCl. The frequencies of vibration of the NaCl lattice have been evaluated for 48 different states of vibration. The frequencies of the residual rays can be found only by taking account of the electrodynamic boundary conditions. The elastic consts. of NaCl have also been evaluated from the coeffs. A. J. M.

Relationship between the critical temperature, b.p., and the parachor values of simple molecules. D. T. LEWIS (Nature, 1940, **145**, 551—552; cf. A., 1938, I, 438).—The major part of the cohesive effect between neutral mols. is exerted probably by electrons not participating in true valency linking. For inert gases, halogen acids, and halogens, the ratio of the coeff. of [P] to this no. of electrons is const. A similar regularity exists when b.p.–[P] equations for a series are considered. L. S. T.

Diffuse scattering of X-rays by crystals. W. H. ZACHARIASEN (Physical Rev., 1940, [ii], **57**, 597—602).—Mathematical. A new derivation of the intensity expression for the coherent scattering of X-rays by a small crystal is made. The Debye formula for the diffuse scattering is shown to be incorrect and is replaced by a more complex expression according to which the intensity varies much more rapidly with the scattering direction and shows a series of diffraction max. The consequences of the theory are discussed in detail. N. M. B.

New diffraction maxima in X-ray photographs. S. SIEGEL and W. H. ZACHARIASEN (Physical Rev., 1940, [ii], **57**, 795—797).—A new intensity expression for diffuse scattering of X-rays by crystals predicts a rapid variation of intensity with scattering angle. New diffraction max. were observed with a rock-salt crystal and Cu $K\alpha$ radiation, and variations of peak intensities and half-widths with direction of incidence were in general agreement with the theory (cf. preceding abstract). N. M. B.

Mosaic structure of metal crystals. M. ŚMIAŁOWSKI (Wiadom. Inst. Met., 1936, **3**, 212—215; Chem. Zentr., 1937, i, 3603).—The mosaic structure of Zn and Cu single crystals depends more on the conditions of solidification than on the orientation of the nucleus. After deep etching with HNO_3 and HCl,

Zn crystals show striations indicating layers as nearly as possible parallel to the basal plane, or a cell structure which is not directly related to the lattice, according as the hexagonal axis is approx. perpendicular or parallel to the direction of retraction of the crystal. The latter type of structure occurs on cube faces of Cu etched with 10% $(NH_4)_2S_2O_8$. The mosaic structure is not destroyed by slight cold-working, recrystallisation, or prolonged heating below the m.p. 99·999% pure Zn shows no marked tendency to give such structures. A. J. E. W.

Directional oxidation of a single crystal of copper by heating in air at reduced pressure. A. T. GWATHMEY and A. F. BENTON (J. Chem. Physics, 1940, **8**, 431—432).—A single spherical crystal of Cu was prepared and surfaced. On heating it in air to (i) 1000° at 0·3 mm. Hg, (ii) 580° at 0·3 mm., (iii) 580° at 4 mm., and allowing it to cool, characteristic oxidation patterns were obtained which show that the reactivity of the crystal varies with the crystal plane along which the surface is prepared. The patterns consist of circular striations and ridges in the crystal surface, which became less prominent on heating the crystal in H_2 at atm. pressure and 580°. It is concluded that (*a*) O_2 must cause a rearrangement of surface atoms and the development of preferred crystal planes at temp. < the m.p. of Cu, (*b*) the pattern depends on pressure and temp., (*c*) on reducing the oxidised surface with H_2, the ridges become less prominent, and if the oxidation is slight, the surface recovers its original appearance. W. R. A.

Specular reflexion of *X*-rays by high-frequency sound waves. (SIR) C. V. RAMAN and P. NILAKANTAN (Nature, 1940, **145**, 667).—The Laue pattern of diamond along a trigonal axis shows additional sharply-defined spots, which are attributed to dynamic stratifications of ρ in the crystal equiv. to stationary waves of high ν (1332 cm.$^{-1}$). L. S. T.

Greatly enlarged *X*-ray shadow images. F. MALSCH (Naturwiss., 1939, **27**, 854—855).—The principle used by Ardenne (A., 1939, I, 492) has been employed for some time in the detection of flaws in material with a "fine-focus" tube. Images up to a magnification of 10 are still satisfactorily sharp. A. J. M.

Structure of uranium subsulphide and of the subphosphides of iridium and rhodium. M. ZUMBUSCH (Z. anorg. Chem., 1940, **243**, 322—329).—U subsulphide (cf. A., 1940, I, 266) has a face-centred cubic lattice of U atoms, implying a formula U_4S_n. By comparison of vals. of ρ calc. for various vals. of *n* with those found for U–S preps. of varying composition, *n* is found to be 3. The structure is of NaCl type, with Na replaced by U and 3 Cl replaced by 3 S, the fourth Cl position remaining vacant. a = 5·494 A., and the shortest U—S and U—U distances are 2·75 A. and 3·88 A. Ir_2P and Rh_2P have the *anti*-CaF_2 structure with a 5·535 and 5·505 A. respectively. The shortest distances are Ir—Ir 2·77, Ir—P 2·40, Rh—Rh 2·75, and Rh—P 2·38 A., giving the at. radii Ir 1·38, Rh 1·37, P (in Ir_2P) 1·02, P (in Rh_2P) 1·01 A. F. J. G.

***X*-Ray dispersion in copper crystals.** E. M. MCNATT (Physical Rev., 1940, [ii], **57**, 621—624; cf. A., 1939, I, 599).—The diffuse scattering of 1·54-A. Cu $K\alpha$ radiation from single crystals of Cu (λ_k = 1·38 A.) was measured for scattering angles 40—120°. At. structure factors calc. by combining results with available average temp.-modified structure factor vals. obtained by the powdered crystal reflexion method are compared with Hartree theoretical at. structure factors and show that the average decrement caused by dispersion is 1·75 against the Hönl val. 2·8 for this ratio of incident to crit. absorption λλ, λ/λ_k = 1·12. N. M. B.

***X*-Ray study of the porphins.** I. WOODWARD (J.C.S., 1940, 601—603).—A preliminary *X*-ray study of tetrabenzporphin, $C_{36}H_{22}N_4$ (I), and tetrabenzmonazaporphin, $C_{35}H_{21}N_5$ (II), gives for (I), a 17·2, b 6·61, c 12·2 A., β 122·5°, vol. of unit cell 1165 A.^{3}, 532 electrons per unit cell, and for (II), a 17·6, b 6·61, c 12·5 A., β 122·7°, vol. of unit cell 1218 A.^{3}, 532 electrons per unit cell. They belong to the same space-group C_{2h}^5 ($P2_1/a$) as the phthalocyanines, but differ considerably from the latter in cell dimensions and packing of mols. Crystals of (II) show strong magnetic anisotropy, the max. susceptibility being normal to the (201) plane. A. J. M.

Scattering of *X*-radiation by liquid helium II. J. REEKIE (Proc. Camb. Phil. Soc., 1940, **36**, 236—241).—Liquid He II at 1·15° and 2·15° K. gives a typical liquid-ring diffraction pattern, with an intensity max. at ~27·5° deviation for *X*-radiation of λ 1·54A. L. J. J.

***X*-Ray study of the primary oxide film on iron.** A. A. KOSCHETKOV (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 76—79).—Alternate layers of Fe and Fe oxide were deposited on a cylinder by evaporation of Fe wire in vac. and exposure to air. These layers were removed as a fine powder and examined by *X*-rays. The lattice const. of the oxide is a = 8·36±0·02 A., which is intermediate between the vals. for Fe_3O_4 (8·38) and γ-Fe_2O_3 (8·32); a increases if the sample is heated for a period in vac. A mechanism to explain the oxidation is advanced. W. R. A.

Determination of the Bravais lattice and the space group [of Na_2BeF_4 crystals]. G. S. SHDANOV and N. G. SEVASTIANOV (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 80).—An extension of previous work (A., 1939, I, 306). Since reflexions of types *hkl* and *hol* have no missing spectra, the crystals have the primitive Bravais lattice, space-group D_{2h}^{16}. W. R. A.

Effect of valency electrons and electron cloud distortion on intensities in electron and *X*-ray scattering. V. A. JOHNSON (Physical Rev., 1940, [ii], **57**, 613—621; cf. A., 1940, I, 287).—The intensity distribution, determined photographically, of electrons scattered by ZnO shows marked anomalies with respect to the intensity distribution of the corresponding *X*-ray pattern. The observed diffraction pattern intensities are accounted for by assuming a polarisation of the *M* shell of the Zn atom, and this hypothesis is tested by calculating the charge

distribution of the M shell under the effect of the electrostatic fields arising from a partly ionic character of the lattice and its deviation from perfect tetrahedral symmetry. The calc. distortion is too small by a factor 1/160 to account alone for the observed anomalies. The effect due to the valency electrons is considered. N. M. B.

Compton line profiles applied to chemical binding. B. L. HICKS (Physical Rev., 1940, [ii], **57**, 665—666).—The method for obtaining new information on the physical state of the electrons forming bonds in gaseous mols. and solids depends on experimental determination of the Compton line shape by the inelastic scattering of X-rays or electrons for the system considered. The fundamental mathematical assumptions are stated. N. M. B.

Structure and orientation of silver halides. H. WILMAN (Proc. Physical Soc., 1940, **52**, 323—347; cf. A., 1939, I, 459).—An electron-diffraction study of the reaction of halogen vapours with the (111)-twinned Ag films prepared by condensation on hot rock-salt cleavage faces, and with similar films reduced to single-crystal structure by heat-treatment, is described. The persistence of the Ag twin spots and lines indicates that both types of diffraction are probably due to twinning alone, and not to the presence of crystal surfaces parallel to octahedral planes. Accurate determinations of lattice consts. give vals. identical with the X-ray val. for normal pure bulk Ag. The Ag halides formed had the normal structures, although the chloride crystals were often, and the cubic iodide crystals always, twinned on (111) planes. N. M. B.

Polish layers on nickel. P. E. AXON (Proc. Physical Soc., 1940, **52**, 312—322).—In view of inconclusive available data on the structure of polish on metals, an etched Ni bullet was fired from a revolver, the rifling ridges creating areas which are subjected to a polishing stroke at great abrasive pressure. A layer is created giving an electron diffraction pattern of diffuse haloes which probably result from a smoothing effect carried out by melting of the projections by heat transferred from the gaseous products of explosion. The depth and chemical composition of the layers are found by removing them by controlled etching and sputtering in an A discharge chamber. N. M. B.

Electron diffraction study of the surfaces of alkali and alkaline-earth metals exposed to air. S. YAMAGUCHI (Nature, 1940, **145**, 742).—Diffraction patterns show that Li_2O (+ LiOH), $NaHCO_3$ (I), $KHCO_3$ (II), and CaO are formed by exposure of the fresh surfaces of the corresponding metals to air for 5 min. Formation of (II) is faster than that of (I), and the film of CaO is > that of MgO formed on Mg under similar conditions (A., 1940, I, 101). L. S. T.

Investigation of thin films of cellulose derivatives by electron diffraction. J. KAKINOKI (Proc. Phys. Math. Soc. Japan, 1939, **21**, 66—74).—In the electron diffraction pattern of cellulose derivatives three haloes are found. It is shown that these are probably due not to imperfections of the crystal lattices, but to the amorphous state of the macro-mols., *i.e.*, the fact that the glucose residues have no definite orientation. A. J. M.

Electron-diffraction study of anodic films [on aluminium, tantalum, and titanium]. R. A. HARRINGTON and H. R. NELSON (Amer. Inst. Min. Met. Eng., 1940, Tech. Publ. 1158, 14 pp.; Met. Tech., 1940, **7**, No. 2).—From the fact that Al anodised at room temp. usually gives diffuse patterns, it is inferred that anodic films formed on Al in a wide variety of electrolytes, *e.g.*, H_2SO_4 and H_3BO_3, are amorphous. Anodic treatment in solutions at higher temp. tends to produce anodic films having less random structure which may possibly be cryst. Heating the anodic film on Al to 650° does not appreciably change its structure, although cryst. oxidation products are formed on unanodised Al at temp. above 300°. Under certain conditions anodic films formed on Ta and Ti are at least partly cryst. and under other conditions they are probably amorphous. Immersion of anodised or unanodised Al in H_2O at temp. above 80° produces a thin film of böhmite (α-Al_2O_3,H_2O). A film produced in this way is transformed into γ'-Al_2O_3 at temp. ~650°. Immersion of Al in boiling chemical solutions gives definitely cryst. forms in contrast to the usual results with anodic treatment. R. B. C.

Intensity distribution in X-ray and electron diffraction patterns. X-Ray atom factors of zinc in zinc oxide and chemical binding. C. H. EHRHARDT and K. LARK-HOROVITZ (Physical Rev., 1940, [ii], **57**, 603—613; cf. Yearian, A., 1935, 1452).—Electron diffraction patterns of ZnO show intensities deviating markedly from those calc. on the assumption of a spherically symmetrical electron distribution in the atom. For a decision between various possible explanations, X-ray diffraction patterns from a flat sample of ZnO were obtained photographically with monochromatic Cu $K\alpha$ radiation, and the relative intensities measured. It is concluded that the observed intensity anomaly must be due to anomalous F factors in the expression for electron diffraction intensity $(Z - F)^2[(\sin\theta)/\lambda]^{-4}$ rather than to effects of dynamical reflexion neglected in the kinematic theory. (Cf. James and Johnson, A., 1939, I, 513, also 1940, I, 286.) Discrepancies at larger vals. of $(\sin\theta)/\lambda$ are discussed in connexion with temp. and order–disorder effects. N. M. B.

Lattice irregularities and their physico-chemical effects. J. A. HEDVALL (Svensk Kem. Tidskr., 1940, **52**, 30—47).—Reversible and irreversible lattice irregularities are discussed. No general treatment of activated lattices is possible. Discontinuities in the properties of lattices around the Curie temp. are discussed. M. H. M. A.

Rochelle salt. (A) Properties. (B) Influence of electrostatic fields on elastic properties. H. MUELLER (Physical Rev., 1940, [ii], **57**, 829—839, 842—843).—(A) A qual. explanation of the anomalous properties of Rochelle salt (I) is given by four theories: (*a*) the dipole theory, (*b*) by assuming polymorphic transitions at the Curie points, (*c*) by postulating an anomalous piezoelectric effect, and (*d*) by an interaction theory assuming no structural or fundamental abnormalities, but ascribing the observed anomalies

to an accidental degeneration of the piezoelectric interaction between the elastic deformation and the electric polarisation. A new experiment establishes a polymorphic transition (shown to be a spontaneous elastic deformation) at the upper Curie point. A quant. analysis of the experimental data leads to a new interpretation of the elastic and piezoelectric measurements and shows that (*b*) and (*c*) are not valid for (I), but that (*a*) is satisfied to a limited extent. The observed Curie points of the free crystal result from the lattice–dipole coupling as described by (*d*).

(B) In accordance with deductions based on the new interaction theory, when a const. potential is applied across electrodes attached to the *a* faces of a plate of (I), all resonance and anti-resonance frequencies show the same kind of variations with temp. and potential as shown for the highest resonance frequency. The frequency–temp. curves have a sharp min. at the Curie point (23·7°). The magnitude of the field effect diminishes at lower and higher temp. N. M. B.

Irreversible variation of the electrical resistance and light-reflecting power of antimony, arsenic, tellurium, iron, and silver layers condensed at low temperatures. R. SUHRMANN and W. BERNDT (Z. Physik, 1940, **115**, 17—46). L. G. G.

Electrical resistance of indium and indium alloys. S. VALENTINER (Z. Physik, 1940, **115**, 11—16).—The sp. resistance of In and of In–Pb and In–Sn alloys has been determined at room and liquid air temp. Results confirm that neither alloy system forms a continuous series of mixed crystals. The sp. resistance of In is $0{\cdot}0903 \times 10^{-4}$ Ω. at 20° and $0{\cdot}0207 \times 10^{-4}$ Ω. at −191°. L. G. G.

Isomerism of the Schiff bases benzylidenebenzhydrylamine and benzhydrylidenebenzylamine. R. CANDEL-VILA and R. CANTAREL (Compt. rend., 1940, **210**, 628—630).—Detailed morphological and goniometric data are given. Benzylidenebenzhydrylamine is monoclinic, with $a : b : c = 1{\cdot}9466 : 1 : 2{\cdot}3545$, β 108° 33′; benzhydrylidenebenzylamine is triclinic, with $a : b : c = 0{\cdot}76802 : 1 : 0{\cdot}94398$, α 95° 47′, β 96° 46′, γ 84° 50′. A. J. E. W.

Grüneisen's constant for the incompressible metals. J. C. SLATER (Physical Rev., 1940, [ii], **57**, 744—746).—Determinations of Grüneisen's const. from thermal expansion, compressibility, and sp. heat, and also from compressibility and change of compressibility with pressure, give approx. the same result except for the more incompressible metals. Redetermination of the change of compressibility of Fe with pressure (cf. Bridgman, A., 1940, I, 155) allows a correction of the vals. for other metals (Fe having been used as a standard) and the removal of the discrepancy. N. M. B.

Relation between breaking and melting. (A) R. FÜRTH. (B) M. BORN (Nature, 1940, **145**, 741, 741—742; cf. A., 1939, I, 552).—(A) The tensile strength of an isotropic body at low temp. is equal to $l\rho(1 - 2b)/(3 - 5b)$, where *b* is Poisson's elastic const., *l* the heat of melting per unit mass, and ρ the density. Vals. given for Ag, Al, Au, Cu, Fe, Ni, etc. agree with experiment.

(B) A comment on the above. Smekal's view that breaking strength belongs to the structure-sensitive properties of solids must be abandoned. L. S. T.

Stability of crystal lattices. (A) M. BORN. (B) R. D. MISRA (Proc. Camb. Phil. Soc., 1940, **36**, 160—172, 173—182).—(A) Stability conditions for the three monat. cubic lattice types are evaluated on the basis of the method of small vibrations. Only data for the long-wave part of the vibrational spectrum are necessary. The method accounts for the known relative stabilities of the three lattice types.

(B) Stability functions for the three lattice types are calc. numerically. L. J. J.

Plastic deformation and recrystallisation of aluminium single crystals. J. A. COLLINS and C. H. MATHEWSON (Amer. Inst. Min. Met. Eng., 1940, Tech. Publ. 1145, 17 pp.; Met. Tech., 1940, **7**, No. 1).—Strain-annealing experiments are reported on a wide variety of orientations covering nearly the entire range of slip on a single system and corresponding with amounts of shear (ratio of shearing distance to distance between lamellæ) at the conclusion of a test of 0·08—0·57. R. B. C.

Photo-elastic property of rock-salt crystals. Y. KIDANI (Mem. Ryojun Coll. Eng., 1939, **12**, 101—114; cf. A., 1937, I, 449).—The use of a half-shadow plate enables very small phase retardations, such as those produced in the photo-elastic effect of rock-salt with small loads, to be determined. The relative coeff. of photo-elasticity of flint glass is $6{\cdot}2 \times 10^{-6}$ per g. cm. The elastic limit of rock-salt and synthetic NaCl crystals is 18—19 g. per sq. mm. The theory of slipping in ionic crystals is developed. A. J. M.

First Benedicks effect in gas-free mercury, as influenced by the mean temperature. C. BENEDICKS and P. SEDERHOLM (Nature, 1940, **145**, 666).—A correction (A., 1940, I, 138). L. S. T.

Electromagnetic induction in water. H. D. EINHORN (Trans. Roy. Soc. S. Africa, 1940, **28**, 143—160).—The e.m.f. induced in H_2O flowing in a magnetic field is ∝ the speed, the magnetic induction, and approx. ∝ the length of the conducting path. The measurable voltage is diminished by an internal voltage drop. For highest sensitivity electrodes should be small. W. R. A.

Calculation of molecular radius from the molecular volume and velocity of sound. W. SCHAAFFS (Z. Physik, 1940, **115**, 69—76; cf. A., 1940, I, 65).—An improved expression for the mol. radius is derived. L. G. G.

Scattering of light by liquid helium. L. I. SCHIFF (Physical Rev., 1940, [ii], **57**, 844—845; cf. Goldstein, A., 1940, I, 149).—Mathematical. Detailed calculations based on London's theory of liquid He (cf. A., 1939, I, 56), for comparison with experiment, lead to arguments against the theory. N. M. B.

Index of refraction of methane in the infra-red and the dipole moment of the CH bond. R. ROLLEFSON and R. HAVENS (Physical Rev., 1940, [ii], **57**, 710—717; cf. A., 1936, 140).—Measurements of *n* for 49 different λλ in the infra-red range 1—15 μ. are tabulated and interpreted in terms of the

active infra-red frequencies of CH_4. Estimates of the dipole moment of the CH bond and the rate of change of this moment with C—H distance are obtained. Measurements show that the infra-red bands are 6 times less strong than would be necessary to remove the discrepancy between $n_\infty - 1$ as obtained by extrapolation from refractive indices and $\epsilon - 1$ determined from dielectric const. measurements. N. M. B.

Optical anisotropy of cellulosic sheets. J. SPENCE (Nature, 1940, **145**, 515; cf. A., 1940, I, 148).—The OH content of the cellulose ester and, to a smaller extent, the solvent content of the sheet affect the orientation of the slow ray in the plane of the stressed sheet. An increase in OH content favours the same direction as that of the stress, whilst the introduction of acyl groups favours the normal direction. Uniaxial cellulose acetate sheets show an approx. linear increase in negative birefringence with a decrease from 44·8 to 27·0% Ac. L. S. T.

Dispersion curves of Jena glass between 400 and 800 mμ. and their representation by the Hartmann interpolation formula. H. SLEVOGT (Z. Instrumkde., 1940, **60**, 37—48).—Vals. of the consts. in the Hartmann formula are tabulated for Jena glasses of the Schott catalogue, and interpolation tables are given for the evaluation of dispersion. O. D. S.

Specific heat of manganese from 16° to 22° K. R. G. ELSON, H. G. SMITH, and J. O. WILHELM (Canad. J. Res., 1940, **18**, **A**, 83—89).—A calorimeter for routine measurement of sp. heat at liquid H_2 and He temp. is described. The at. heat of Mn from 16° to 22° K. is $0{\cdot}00421T + 464(T/410)^3$. O. D. S.

B.p. of *n*-heptane and ββδ-trimethylpentane over the pressure range 100—1500 mm. E. R. SMITH (J. Res. Nat. Bur. Stand., 1940, **24**, 229—234).—The b.p. of these compounds have been determined at various pressures by means of Swientoslawski ebulliometers, using H_2O as reference material. Equations are derived expressing the relationship between v.p. and temp.; the b.p. at 760 mm. are 98·428° and 99·232°, respectively. J. W. S.

B.p. of magnesium and magnesium alloys. A. SCHNEIDER and U. ESCH (Z. Elektrochem., 1939, **45**, 888—893).—If Mg is heated in SO_2, a rapid reaction causing an abrupt rise of temp. sets in at the b.p., owing to the destruction of a protective layer of reaction products on the molten Mg surface and consequent rapid supply of Mg to the vapour phase. This effect is used to determine the b.p. of Mg (1103±5°) and of alloys of Mg with 0—40 at.-% of Ag, Al, Sn, Pb, and Cu. The b.p. elevations show that the melts of these alloys contain $\not>10\%$ of compound mols., MMg_2 (probably none), and may be considered as ideal conc. mixtures in the neighbourhood of the b.p. A. J. E. W.

B.p. of selenium. M. DE SELINCOURT (Proc. Physical Soc., 1940, **52**, 348—352).—A precision determination of the b.p. of Se was made using a Si boiling tube method and varying the pressure from 700 to 800 mm. The val. in terms of the international temp. scale is 684·8±0·1° at 760 mm., with a variation of 1·08° per cm. of Hg. N. M. B.

Angle of repose of snow on solids. R. SCHNURMANN (Nature, 1940, **145**, 553—554).—Data recorded for loose and compressed snow at room temp. on bakelite, glass, ferrotype, and steel show that the angle of repose of compressed snow is < that of loose snow. The porosity of loose snow hinders the establishment of thick film lubrication by the melt. L. S. T.

Thermal expansion of invar. L. F. BATES and J. C. WESTON (Nature, 1940, **145**, 550—551).—The coeff. of thermal expansion of invar has been determined by measuring the changes in temp. that occur when a rod is suddenly stretched and when it is taken through a hysteresis cycle (cf. A., 1940, I, 152). The val. obtained is $0{\cdot}411 \times 10^{-6}$ per °C. L. S. T.

Velocity distribution of gaseous molecules. Table for obtaining values of the error function complement. A. H. HEATLEY (Canad. J. Res., 1940, **18**, **B**, 123—127).—Vals. from $x = 0$ to 20 of the function $L(x) = 2xe^{x^2}\int_x^\infty e^{-t^2}dt$, which may be used to obtain the true velocity distribution of gaseous mols. from the distribution obtained by considering motion in two dimensions only, are tabulated. Vals. of Miller and Gordon's function, $F(x)$ (cf. A., 1931, 1368), from $x = 10$ to 20 are tabulated. O. D. S.

Coexistence of liquid and gaseous states of aggregation in the critical temperature region. Ethane. S. G. MASON, S. N. NALDRETT, and O. MAASS (Canad. J. Res., 1940, **18**, **B**, 103—117).—A study has been made of the position and nature of the meniscus and distribution of opalescence in bombs containing C_2H_6 as the crit. temp. is approached. The d–T coexistence curve has the classical parabolic form up to 32·23±0·015°, at which point the curve becomes flat along the d axis. By shaking the bomb the crit. temp. T_s can be found accurately and without ambiguity, and the importance of shaking in assisting the attainment of equilibrium between liquid and gaseous phases is shown. C. R. H.

Coexistence of the liquid and gaseous states of aggregation in the critical temperature region. Ethylene. S. N. NALDRETT and O. MAASS (Canad. J. Res., 1940, **18**, **B**, 118—121).—The technique used in the case of C_2H_6 (cf. preceding abstract) has been followed in studying the crit. behaviour of C_2H_4. $T_s = 9{\cdot}21 \pm 0{\cdot}015°$. The shape of the coexistence curve is the same as that for C_2H_6. The term "crit. dispersion temp." is suggested for T_s. C. R. H.

Fundamental principles of energetics. J. N. BRØNSTED (Phil. Mag., 1940, [vii], **29**, 449—470).—A general system of energetic principles is constructed on the basis of quantity and potential concepts. L. J. J.

Viscosity and molecular structure. H. MARK and R. SIMHA (Nature, 1940, **145**, 571—573).—A review. L. S. T.

Dependence of viscosity of liquids on constitution. A. H. NISSAN, L. V. W. CLARK, and

A. W. NASH (J. Inst. Petroleum, 1940, **26**, 155—211).—Details are given of results recorded previously (A., 1939, I, 411). It is assumed that the ultimate unit of a liquid flows in a series of jumps, and that the crit. energy (Q) required to permit the particle to jump is given by $\eta = Ae^{Q/RT}$. The view is confirmed by the observation that log η when plotted against $T/T_{b.p.}$ gives a smooth curve (sp. viscosity curve) for 137 liquids. The ratio L/Q (L = mol. latent heat of vaporisation) is a const. characteristic of each liquid, being lowest for metals and highest for simple gases (A, N_2, CO, CH_4). The inclination of the sp. viscosity curve is influenced principally by mol. shape, whilst dipole effects have only a secondary importance. J. W. S.

Measurement of viscosity in the critical region. Ethylene. S. G. MASON and O. MAASS (Canad. J. Res., 1940, **18, B**, 128—137).—A precision oscillating-disc viscometer for use between 0° and 100° and at pressures up to 150 atm. with differential accuracy 1 in 3000, abs. accuracy 1 in 1000, is described. A continuous transition in the viscosity (η) of C_2H_4 occurs along the equilibrium isochore in the crit. region with min. η at 9·9°. The variation of η with density in the crit. region is similar to that observed by Schröer (A., 1935, 925) for Et_2O. O. D. S.

Thermal diffusion. S. P. FRANKEL (Physical Rev., 1940, [ii], **57**, 661; cf. Furry, A., 1939, I, 395).—Mathematical. A method, based on elementary considerations, of showing the existence and sign of thermal diffusion is described. N. M. B.

Osmotic diffusion in gases. E. J. HELLUND (Physical Rev., 1940, [ii], **57**, 737—742).—Mathematical. The theory of diffusion induced in a "solvent" gas by the pressure diffusion of two other gases is developed from formulæ previously derived (cf. A., 1940, I, 203). The analysis is applied to the Loschmidt experiment and the pressures generated are found analytically as a function of time elapsed from the onset of diffusion. N. M. B.

Viscosity-concentration relations. IV. H. L. BREDÉE and J. DE BOOYS (Kolloid-Z., 1940, 39—46).—The two-const. formula proposed earlier (cf. A., 1937, I, 303, 355) has been further applied to colloidal and non-colloidal solutions in H_2O and org. liquids and to emulsions and has been fully confirmed. The relation between the "voluminosity" and the "extension" factors reveals an essential difference between natural (asphaltic bitumens) and synthetic (polymerised ω-hydroxydecoic acid) high polymerides. Papers by Hess and Philippoff (A., 1937, I, 360) and by Sakurada (A., 1938, I, 246) are critically examined. F. L. U.

(A) Viscosity in the ternary systems: phenol-benzene-aniline, -dimethylaniline, and -diethylaniline. (B) Cryoscopic study of the systems phenol-aniline, -dimethylaniline, and -diethylaniline. V. V. UDOVENKO and A. P. TOROPOV. V. V. UDOVENKO and M. I. USANOVITSCH (J. Gen. Chem. Russ., 1940, **10**, 11—16, 17—20).—(A) The η-composition curves suggest formation of PhOH-NH_2Ph, -$NPhMe_2$, and -$NPhEt_2$ compounds; the max. become less well-defined as the [C_6H_6] rises.

(B) The apparent mol. wt. of NH_2Ph and $NPhMe_2$ in C_6H_6 rises with increasing concn.; that of $NPhEt_2$ remains const. In PhOH the apparent mol. wt. falls with rising concn. The mean apparent mol. wt. of mixtures of PhOH and amines in C_6H_6 is > would follow from the additive rule, to a degree increasing with their concn. R. T.

Azeotropes of 2-methylfuran. A. A. PRIANISCHNIKOV and L. L. GENIN (J. Appl. Chem. Russ., 1940, **13**, 140—141).—The following azeotropic mixtures are described: 2-methylfuran (I)-MeOH, b.p. 51·5—51·6° (MeOH 22·3%), (I)-MeOH-H_2O, b.p. 58·2—58·5°, (I)-$COMe_2$-H_2O, b.p. 55·6°. (I) does not afford azeotropic mixtures with MeOAc, EtCHO, or COMeEt. R. T.

Velocity and absorption of ultra-acoustic waves in some binary liquid mixtures. I. G. MICHAILOV (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 145—146).—The velocity of ultra-acoustic waves in EtOH-H_2O mixtures has a max. val. at a concn. ~30% EtOH (vol. per vol. of mixture). A decrease in the diffraction of light by the waves is found in the concn. region 30—40%. At 35% concn., no dispersion is found in the frequency range 1·47—5·31 megacycles. L. J. J.

Dielectric capacity of electrolytes in mixed solvents: ion association in solutions of magnesium sulphate. W. A. MASON and W. J. SHUTT (Proc. Roy. Soc., 1940, **A, 175**, 234—253).—A method for determining the dielectric const. (ϵ) of a conducting liquid is described. Results are obtained for dioxan-H_2O mixtures and aq. solutions of $CO(NH_2)_2$. ϵ of solutions of $MgSO_4$ in these aq. solvents has been determined. It is concluded that the behaviour of electrolytes in solution can be described by consideration of the simple coulomb forces involved without invoking a sp. influence due to the chemical nature of the solvents. G. D. P.

Application of Beer's law of absorption to solutions. W. V. BHAGWAT (J. Indian Chem. Soc., 1940, **17**, 53—59).—The applicability of Beer's law to a no. of aq. solutions has been tested. It holds approx. for $K_2Cr_2O_7$, picric acid, $Dy(NO_3)_3$, chromic acid, $Ni(NO_3)_2$, $NiSO_4$, and methylene-blue, but fails for $NiCl_2$, $CoCl_2$, and Me-violet. F. J. G.

Viscosity of solutions of sodium chromate and of technical chromate solutions. I. G. RISS (J. Appl. Chem. Russ., 1939, **12**, 1787—1789).—η-concn. and η-temp. curves are given for Na_2CrO_4 solutions. R. T.

Refractometric measurement of free diffusion of soaps in aqueous solution. O. LAMM and H. HÖGBERG (Kolloid-Z., 1940, **91**, 10—19).—The method previously described (cf. A., 1936, 563) has been used to determine diffusion coeffs. (D) of Na octoate, decoate, and dodecoate at 20°. In all three the D-concn. curve presents a region of decreasing D, the upper limit of which is at a concn. which is the lower, the higher is the mol. wt. F. L. U.

Metallographic study of internal oxidation in α-solid solutions of copper. F. N. RHINES (Amer.

Inst. Min. Met. Eng., 1940, Tech. Publ. 1162, 41 pp.; Met. Tech., 1940, **7**, No. 2).—40 binary Cu α-solid solution alloys were subjected to oxidation in air and in a closed container packed with powdered $Cu-Cu_2O$. Internal oxidation was found in binary Cu alloys containing Al, Sb, As, Ba, Be, B, Cd, Ca, Ce, Cr, Co, Ga, Ge, In, Fe, Pb, Li, Mg, Mn, Ni, Nb, P, Se, Si, Na, Sr, Ta, Sn, Ti, W, V, Zn, and Zr. External oxidation alone was found in alloys with Ag, Pt, and Pd. The behaviour of alloys containing Bi, S, Te, and Tl was uncertain. The particle size of the pptd. oxides varies with the chemical nature of the alloying element, the concn. of the alloy, and the oxidation temp. Very stable oxides tend to form fine ppts. whilst the less stable ones form coarse ppts. High oxidation temp. and high concns. of the alloying element favour a large particle size. Extensive agglomeration is rarely found. Distribution of the ppt. varies from system to system and is affected by oxidation temp. The rate of growth of the subscale decreases with time, with increasing alloy concn., with fall in temp., and with lowered O_2 pressure. The time to form a given thickness of subscale is almost ∝ the concn. of the alloy. Ternary alloys containing Cu with Sn or Zn and Al, Be, or Si all exhibit double zones of oxidation, the outer band containing the oxides of both metals and the inner band the oxide of only one metal. R. B. C.

Chromium–silicon alloys. N. N. Kurnakov (Compt. rend. Acad. Sci., U.R.S.S., 1940, **26**, 362—364).—Thermal analysis of the system Cr–Si confirms the presence of the compounds CrSi and $CrSi_2$. The hardness of the alloys shows max. at the compositions of these compounds, whilst the sp. vol.–composition curve also shows breaks at these points. J. W. S.

Ferromagnetic anisotropy, magnetisation at saturation, and superstructure in Ni_3Fe and nearby compositions. E. M. Grabbe (Physical Rev., 1940, [ii], **57**, 728—734; cf. A., 1939, I, 247).—Investigation of spheroidal specimens of Fe–Ni alloys (Ni 65—80%) showed that with superlattice formation the anisotropy becomes more like that of pure Ni with (111) as the direction of easiest magnetisation. The change is largest near Ni_3Fe. The saturation magnetisation increases with ordering; the greatest observed increase was 5·8% for an alloy very near Ni_3Fe. Different rates of cooling from the crit. temp. (~490°) affect the saturation magnetisation. The changes are attributed to changes in degree of local ordering effects. Long-distance order, induced by baking for long periods, greatly influences anisotropy and magnetisation at saturation. N. M. B.

Young's moduli of alloys at low temperatures.—See B., 1940, 453.

Crystals of silico-chromium. N. N. Kurnakov and G. B. Boki (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 358—361).—In Cr–Si–Fe alloys of Si contents 27·9—32·4, 33·7—37·5, and ~46·5% the crystals formed are hexagonal prisms, coaxially intergrown tetrahedra, and needles, respectively. With alloys containing >52·4% of Si no pronounced cryst. forms are observed. J. W. S.

Equilibrium diagram of the system iron–silicon–vanadium. R. Vogel and C. Jentzsch-Uschinski (Arch. Eisenhüttenw., 1939—40, **13**, 403—408).—The system contains a ternary compound $(FeSi)_4V_5$ (*T*) which is the end member of the ternary α series of solid solutions. FeSi and VSi_2 form a simple eutectiferous pseudobinary system; the eutectic has V 15%, m.p. ~1310°. In the ternary system the primary crystallites consist of Fe–V solid solution, FeSi, VSi_2, V_2Si, or *T* or mixtures of two or more of these according to the composition. There are six four-phase reactions and a fairly wide range of immiscibility. The ternary diagram and various sectional diagrams are given together with photographs of characteristic microstructures in the system. A. R. P.

Cobalt–nickel–silicon system between 0 and 20% of silicon. A. C. Forsyth and R. L. Dowdell (Amer. Inst. Min. Met. Eng., 1940, Tech. Publ. 1170, 15 pp.; Met. Tech., 1940, **7**, No. 2).—A partial diagram of the ternary Ni–Co–Si alloys has been constructed from a study of 76 alloys containing up to 19·3% of Si. Data on thermal analysis and structure, a typical cooling curve, representative photomicrographs, and details of sections through the ternary diagram are given. Ni and Co appear to replace one another in these alloys, producing only two phases in stable equilibrium. The α solid solution alloys are capable of being wrought. Alloys containing >10% of Si are brittle but corrosion-resistant. Alloys containing the α constituent are magnetic. R. B. C.

Oil–water-solubility of argon compared with helium and nitrogen.—See A., 1940, III, 479.

Solubilities of lanthanum, praseodymium, and neodymium chlorides. J. N. Friend and R. W. Hale (J.C.S., 1940, 670—672).—Data are tabulated for $LaCl_3,7H_2O$, $PrCl_3,7H_2O$, and $NdCl_3,6H_2O$ between 0° and 100°. The solubilities of the first two are almost identical up to 80°; that of $NdCl_3,6H_2O$ is appreciably smaller above and slightly greater below 55°. F. L. U.

Thermodynamic derivation of Langmuir's isotherm. G. S. Rushbrooke and C. A. Coulson (Proc. Camb. Phil. Soc., 1940, **36**, 248—251).—Langmuir's adsorption isotherm is derived for the cases of adsorption energy independent of, and varying with, the temp. L. J. J.

Adsorption at interface between two fluids. III. Adsorption of dyes at a mercury–water interface. C. W. Gibby and C. Argument (J.C.S., 1940, 596—600; cf. A., 1936, 1334).—The adsorptions of methylene-blue, Congo-red, Bordeaux extra, indigo-carmine X, and Solway ultra-blue B at a $Hg-H_2O$ interface all pass through a max. with increasing concn., and are always positive. Adsorptions calc. from measured interfacial tensions by Gibbs' equation do not agree with the observed vals., and are sometimes negative. F. L. U.

Radioactive methods of determining ion adsorption at crystal surfaces. II. L. Imre (Kolloid-Z., 1940, **91**, 32—39; cf. A., 1939, I, 316).—An approx. equation is derived according to which the no. of active centres in the surface of an adsorbent

increases exponentially with the heat of dissolution of the adsorbent. The active fraction of the surface calc. by this equation agrees with that found from measurements of the adsorption of $Pb^{\cdot\cdot}$ on $PbSO_4$ from various $EtOH-H_2O$ mixtures. It is shown that true adsorption isotherms for such systems as $Pb^{\cdot\cdot}-BaSO_4$ can be constructed from measurements with a radioactive indicator, although the indicator itself undergoes only exchange adsorption. F. L. U.

Electrolyte adsorption and activity coefficient. IV. Adsorption of strong acids on carbon and its calculation. S. Broese (Kolloid-Z., 1940, **91**, 20—32).—The adsorption of HCl and of H_2SO_4 on different varieties of charcoal has been measured over the concn. range 0·005—2M. The linear relationship $f_x = af_{c-x} + b$ (cf. A., 1939, I, 366) is valid over the range of medium concns., and the curves for both acids coincide when de-ashed C is used as adsorbent. F. L. U.

Adsorption of dipoles. A. R. Miller (Proc. Camb. Phil. Soc., 1940, **36**, 242—243; cf. A., 1940, I, 158).—A correction. L. J. J.

Electrokinetic aspects of surface chemistry. IX. Electric mobilities of quartz and collodion particles in mixtures of horse serum and serum-proteins in relation to the mechanism of film formation. L. S. Moyer and M. H. Gorin (J. Biol. Chem., 1940, **133**, 605—619).—Determination of the electrophoretic mobilities of quartz and collodion particles initially coated with albumin *B* and placed in albumin *A* showed that with the quartz only was the film replaced by albumin *A*. When coated originally with *A*, albumin *B* was not adsorbed. Albumin *B* did not replace globulin, whereas globulin replaced albumin *B* partly on quartz and completely on collodion. In no case did replacement of globulin by albumin occur. The biological significance of these findings is discussed. A. L.

Haidinger's rings in soap bubbles. (Sir) C. V. Raman and V. S. Rajagopalan (Proc. Indian Acad. Sci., 1939, **10**, **A**, 317—323).—Interference patterns of uniform and non-uniform soap bubbles have been photographed in transmitted and reflected light and are discussed. W. R. A.

Transformations in monolayers. D. G. Dervichian (J. Chem. Physics, 1940, **8**, 347).—A reply to Harkins and Boyd (A., 1940, I, 159). W. R. A.

Monolayers on solids. I. Langmuir (J.C.S., 1940, 511—543).—A lecture incorporating new results and theories. Data on the rate of disappearance of H_2 from mixtures of O_2 and H_2 in contact with glowing W filaments (1500—2500°) are given. While O_2 is present (disappearing at a rate $\propto p_{O_2}$), H_2 also disappears at a rate $\propto p_{H_2}$ but independent of p_{O_2}, and $\ll$ the rate in absence of O_2. These results indicate that there is a stable monolayer of O atoms, over which atoms or mols. of O belonging to a sparse and loosely-bound second layer migrate freely. [O] in the second layer is $\propto p_{O_2}$. Loss of O_2 involves evaporation of WO_3, O being contributed by both layers and the resulting hole in the first layer being usually refilled immediately from the second layer. Disappearance of H_2 can occur only on activation by contact with the bare W surface, *i.e.*, only in such a hole, so long as gaseous O_2 is present. The great difference in stability of the second layer is connected with the short range of adsorption forces; in general the force holding an adsorbed atom on a surface may be $\ll$ or $\gg$ that holding a second adsorbed atom to the first. The first case is exemplified by Cd on glass; it is calc. that the rate of evaporation of Cd atoms from a first layer on glass is $>$ that from a second layer by a factor $\sim 10^{11}$. In the other case a stable monolayer may be formed at pressures $\ll$ saturation, whereas a further layer begins to form only at pressures near saturation. The hyperbolic adsorption isotherm involves the simplifying assumptions that there is one adsorbed atom to each site, and that neighbouring adsorbed atoms do not influence one another. Isotherms resulting from more general considerations are discussed, and an application to the case of Cs on W, allowing for repulsion between Cs dipoles, gives satisfactory agreement. When the adsorbed atoms are larger than the distances between sites, one atom excludes others from neighbouring sites. It is shown that this will result in the adsorbed atoms on a crowded surface forming two identical surface phases separated by boundary regions in which they are less closely packed. Rapid changes of p or T result in evaporation or condensation in both of these, but slow equilibration can also occur (either by surface migration or by evaporation and condensation) with progressive shortening of the boundaries. This corresponds with certain cases of activated adsorption which have hitherto been supposed to involve diffusion into the interior of the adsorbent. F. J. G.

Permeability of organic polymerides. R. M. Barrer (Trans. Faraday Soc., 1940, **36**, 644—648; cf. A., 1939, I, 317).—Data for the permeability of membranes of Bakelite, ebonite, polyethylene, and Cellophane to He, H_2, and N_2, and of celluloid and nitrocellulose to H_2, are recorded. Vals. of the activation energy of permeation are calc. The results are discussed and related to previous data. F. L. U.

Scattering of polarised light in colloids. R. S. Krishnan (Proc. Indian Acad. Sci., 1939, **10**, **A**, 395—398).—When a horizontal beam of polarised light is passed through a colloidal solution the light scattered transversely is depolarised to an extent which depends on the optical properties of the colloid and on the inclination of the plane of polarisation of the incident beam to the vertical. A formula is derived for the depolarisation factor and applied to graphite and As_2S_3 sols and PhMe emulsions; the agreement is not very close. W. R. A.

Dielectric measurements with colloids. H. R. Kruyt and H. Kunst (Kolloid-Z., 1940, **91**, 1—10; cf. A., 1937, I, 615).—Dielectric consts. (ϵ) of sols of Na arabate (I), Na agar, starch (II), AgBr, AgI, and As_2S_3 have been determined with $\lambda\lambda$ 150—1930. Among the lyophilic sols (II) has the smallest and (I) the highest ϵ, corresponding with the relative magnitudes of the micellar charge. Na ions, which have a dehydrating action on (I), do not affect its ϵ; on the other hand $Ba^{\cdot\cdot}$ and $[Co(NH_3)_6]^{\cdot\cdot\cdot}$, which displace $Na^{\cdot}$ and form a less developed double layer, depress it

strongly. Among the lyophobic sols ϵ decreases in the order As_2S_3 >AgI >AgBr, which is also the order of decreasing charge density. These results indicate that a high ϵ in sols is due in large measure to polarisation of the double layer. F. L. U.

Silver organosols. I. Preparation by the reaction between chlorinated oils and silver oxide. II. Particle size and stability. T. MATSUMOTO and S. IWAI (J. Soc. Chem. Ind. Japan, 1940, **43**, 18—20B, 20—22B).—I. Ag sols in sardine, olive, and linseed oils are prepared by boiling a suspension of Ag_2O in a solution of the chlorinated oil in an org. solvent, and removing excess of Ag_2O and the solvent by centrifuging and distillation. The uptake of Ag is independent of the Cl content of the oil, except at high contents, and rises with rising b.p. of the solvent. The sols may be conc. by adding a hydroxylic solvent or mixture, incompletely miscible with the oil, when sols containing 55·8—95·4% Ag separate as a lower layer. The sols are lyophobic and contain particles of Ag and AgCl.

II. The particle size, determined ultra-microscopically or from the Brownian movement displacement, is ~0·1 μ., and decreases with rising temp. of prep. The particles are uncharged. Sols from unchlorinated oils are lyophilic and contain much larger particles. Dispersions of Ag soaps also contain large particles and are lyophilic. In diffuse light the Ag organosols are pptd. Pptn. is accelerated by Ag soaps, but retarded by soaps of Cu, Pb, or Cd. W. A. R.

Colloidal electrolytes. J. W. MCBAIN (Nature, 1940, **145**, 702—703).—Mainly a review. Ionic micelles begin to form in very dil. solution and steadily increase throughout parallel to the thermodynamic necessity that the concn. of simple ions likewise must increase throughout the range of stable solution. The lamellar (formerly called "neutral") micelles arise from ion-pairs and higher aggregates, increasing in size and amount until their development is sufficient to produce an *X*-ray pattern in the solution. L. S. T.

Relations between elasticity, anomalies of flow, and ability to be spun into thread of sols.—See A., 1940, III, 470.

Effect of surface-active substances on mechanical properties and formation of soap coagels. V. MOKIEVSKI and P. REBINDER (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 48—51).—An extension of previous work (cf. A., 1939, I, 259) to soap coagels (curds). Primary crystals of coagels flocculate rapidly. Addition of surface-active substances decreases flocculation markedly and lowers the rigidity of the curd. Mechanical resistance to shear has been measured for (i) a 5% Na stearate coagel containing Bu^aOH, n-C_6H_{13}·OH, n-C_7H_{15}·OH, and n-C_8H_{17}·OH at 10° or 25°, (ii) a 15% Na stearate coagel containing Bu^aOH, n-C_8H_{17}·OH, NH_2Ph, PhOH at 10° or 25°, and (iii) a 15% Na dodecoate coagel containing n-C_8H_{17}·OH. Soaps themselves act on each other like typical surface-active admixtures. W. R. A.

Sodium oleate gels in pinene. M. PRASAD and K. N. MATHUR (Current Sci., 1940, **9**, 119).—Na oleate (I) dissolves in pinene at 140° and sets to a transparent gel, for which the time of setting decreases as the proportion of (I) is increased and as the temp. of setting is lowered. The heat of activation for the setting process and the syneresis are both negative. n is nearly independent of the concn. of (I) but decreases approx. linearly with increasing temp. of setting. F. R. G.

Solubility of β-cellulose in aqueous solutions.—See B., 1940, 435.

Solutions of cellulose in halogenoacetic acids.—See B., 1940, 435.

Solubility and swelling of high polymerides in ternary mixtures. J. N. BRÖNSTED and K. VOLQVARTZ (Trans. Faraday Soc., 1940, **36**, 619—624; cf. A., 1939, I, 319).—Triangular equilibrium diagrams (20°) have been constructed for polystyrene (I) and pairs of liquids consisting of solvent + non-solvent, solvent + swelling agent, non-solvent + swelling agent, and swelling agent + swelling agent, chosen from the following: EtOH, Bu^aOH, $COMe_2$, Me, Et, and Pr^a dodecoates, *iso*-C_5H_{11}·OBz, CH_2Ph·OBz, Bu^a sebacate, MeCN, OH·$[CH_2]_2$·OAc, $Bu^a{}_2O$, $(CH_2Ph)_2O$, and *m*-cresol. In all cases the final equilibrium is between a binary liquid containing no (I) and a ternary swollen phase. The existence of ternary crit. points is indicated. F. L. U.

Properties of polymerides in solution. XII. Free energy and heat of dilution. System rubber–toluene. K. H. MEYER, E. WOLFF, and C. G. BOISSONNAS. **XIII. Free energy and heat of dilution. System gutta-percha–toluene.** E. WOLFF. **XIV. System cellulose triacetate–tetrachloroethane.** O. HAGGER and A. J. A. VAN DER WYK. **XV. Summary of thermodynamic properties of binary liquid systems.** K. H. MEYER and A. J. A. VAN DER WYK (Helv. Chim. Acta, 1940, **23**, 430—439, 439—441, 484—487, 488—496).—XII. The osmotic pressures (Π) and sp. vols. (V) of 0—5% solutions of rubber in PhMe have been measured at 24·4° and at 35·6° and the partial free energy (ΔG), heat content (ΔH), and entropy (ΔS) changes during dilution are calc. ΔS is > the ideal val. The v.p. of various solutions of rubber in PhMe have been determined and the activity of PhMe in these solutions is deduced.

XIII. Π and V for 1—4% solutions of gutta-percha in PhMe have been measured at 24·4° and 35·6°, and ΔG, ΔH, and ΔS for the dilution are calc. ΔS is > the ideal val.

XIV. Π and V for 0·4—4% solutions of cellulose triacetate in $C_2H_2Cl_4$ have been measured at 24·4° and 35·7°, and ΔG, ΔH, and ΔS for the dilution are deduced. ΔS is < the ideal val. The calc. mol. wt. of the solute is 41,800 ± 2000.

XV. A review of the thermodynamic functions of binary liquid mixtures indicates that for systems containing small mols. ΔH generally determines the sense of the departure of ΔG from the ideal val., but that with strongly exo- or endo-thermic solutions and in systems in which one component has very anomalous properties ΔS diverges considerably from the ideal val. and causes a corresponding change in ΔG. In systems comprising mols. of greatly differing

size ΔS is > the ideal val. and leads to abnormal vals. of ΔG. In solutions containing long-chain macro-mols. ΔS is < the ideal val. and may even be negative, so the divergence of the val. of ΔG from the ideal val. is attributable to anomalous vals. of ΔH. With large compact mols. (hæmoglobin) ΔG has almost the ideal val. In systems containing macro-mols. of limited solubility ΔS is slightly negative; in such cases there is a solvation of the solute and ΔG is $\ll \Delta H$. J. W. S.

Osmotic relations between egg-white and egg-yolk.—See A., 1940, III, 607.

Sediment volumes of multidisperse kaolin powders in electrolyte solutions. II. G. G. KANDILAROV (Kolloid-Z., 1940, **91**, 56—61).—The previously noted observations (A., 1940, I, 254) have been extended to tervalent anions and data are now recorded for Na_2HPO_4 and Na_3PO_4. A comparison of the effects of HCl, NaOH, $AlCl_3$, and Na_3PO_4 indicates that in the two last the effects observed are partly due to the $H^{\cdot}$ and OH' produced by hydrolysis. In general, the effects of the various species of ion present are additive. F. L. U.

Electrokinetic studies of silk.—See B., 1940, 434.

Gas equilibria $C_2 \rightleftharpoons 2C$, $S_2 \rightleftharpoons 2S$, $Se_2 \rightleftharpoons 2Se$, and $Te_2 \rightleftharpoons 2Te$. H. ZEISE (Z. Elektrochem., 1940, **46**, 38—41).—Vals. of K_p for $C_2 \rightleftharpoons 2C$ (2000—6000° K.) and $S_2 \rightleftharpoons 2S$ (298·1—3000° K.) are recalc. by a thermodynamic-statistical method, using modern spectroscopic vals. for the dissociation energies and the S—S distance. Vals. for the two other equilibria at 1000—2500° K. are also calc., and the results agree with previous experimental data if the ground states of Te_2 and Se_2 are assumed to be of the $^3\Sigma$ type. A. J. E. W.

Errors in the determination of the dissociation constant of a weak acid by the extrapolation method. M. L. KILPATRICK (J. Chem. Physics, 1940, **8**, 306—313).—Mathematical. Equations have been derived expressing the effect of errors in conductivity data for weak acids on the vals. of dissociation consts. and of Λ_0 calc. from these data. Numerical vals. of the errors for aq. solutions are tabulated and the detection of const. errors is discussed. W. R. A.

Dissociation constant of azoimide. (MLLE.) M. QUINTIN (Compt. rend., 1940, **210**, 625—627).—Aq. solutions of HN_3 (≯0·88 M.), prepared from aq. NaN_3 and H_2SO_4, are stable for ~50 days under N_2 in closed vessels free from dust. Vals. of p_k obtained by electrometric titration in aq. KCl solutions of different ionic strengths (μ) give $pK = 4{\cdot}55$ ($K = 2{\cdot}8 \times 10^{-5}$) on extrapolation to $\mu = 0$; the slope of the $p_k - \sqrt{\mu}$ curve is $-0{\cdot}35$ at low μ, in accord with the Debye–Hückel theory. A. J. E. W.

Second ionisation constant and related thermodynamic quantities for malonic acid from 0° to 60°. W. J. HAMER, J. O. BURTON, and S. F. ACREE (J. Res. Nat. Bur. Stand., 1940, **24**, 269—292).—From e.m.f. measurements on cells of the type Pt,H_2|Na H malonate (I) (m_1), Na_2 malonate (II) (m_2), NaCl (m_3)|AgCl|Ag, the second dissociation const. of malonic acid has been determined at 0—60°. The heats of ionisation and the free energy and entropy changes are calc. for various temp. Solutions containing equal concns. (0·001—0·044M.) of (I), (II), and NaCl form buffers suitable for use as p_H standards. J. W. S.

Ionisation constants of substituted quinolines and tetrahydroquinolines.—See B., 1940, 477.

Equilibria in the system P_2O_5–water. K. I. ZAGVOZDKIN, J. M. RABINOVITSCH, and N. A. BARILKO (J. Appl. Chem. Russ., 1940, **13**, 29—37).—The equilibria $2H_3PO_4 \rightleftharpoons H_4P_2O_7 + H_2O$; $H_4P_2O_7 \rightleftharpoons 2HPO_3 + H_2O$, shift from left to right with increasing temp. and diminishing pressure. R. T.

Affinity. XCII. Iridium phosphides. K. H. SÖFFGE, M. HEIMBRECHT, and W. BILTZ (Z. anorg. Chem., 1940, **243**, 297—306).—The system Ir–P has been studied by means of *X*-rays and (in part) of tensimeter curves. IrP_2 and Ir_2P are the only compounds and there are no indications of solid solutions. IrP_2 has ρ_4^{25} 9·15; its dissociation pressure is small at 850°, and it is only slowly attacked by aqua regia. Ir_2P has ρ_4^{25} 16·0, m.p. ~1350°; it is not attacked by aqua regia or by fused Na_2O_2. There appears to be a eutectic at ~1290°, with Ir : P ~4 : 1. The mol. vol. increment for P is 9·7 in IrP_2 and 9·0 in Ir_2P. F. J. G.

(A) Equilibrium between metallic and non-metallic phases in the molten state. J. K. DELIMARSKI. **(B) Equilibrium $Cd + PbBr_2 \rightleftharpoons CdBr_2 + Pb$, in molten aluminium bromide–potassium bromide solution.** J. K. DELIMARSKI and L. S. BERENBLUM (Mem. Inst. Chem. Ukrain. Acad. Sci., 1940, **6**, 93—129, 131—147).—(A) The literature is reviewed.

(B) The reaction $Cd + PbBr_2 \rightleftharpoons CdBr_2 + Pb$ proceeds according to the law of mass action in molten $AlBr_3$–KCl at 360—460°; its conformity with this law is the closer the more dil. are the solutions. R. T.

Vaporisation equilibria. M. GILBERT (Chem. Met. Eng., 1940, **47**, 234—235, 249).—A series of curves is plotted which enables the % vaporisation of a given mixture to be obtained with only 3 preliminary trial calculations. The curves relate to complex mixtures obeying Henry's and Raoult's laws. D. F. R.

Vapour pressure of saturated solutions and solubility in the system CaO–P_2O_5–H_2O. A. P. BELOPOLSKI, M. T. SEREBRENNIKOVA, and A. V. BILEVITSCH (J. Appl. Chem. Russ., 1940, **13**, 3—8).—The results of Bassett (cf. A., 1908, ii, 675) are confirmed. The v.p. of the saturated solutions is > that of aq. H_3PO_4 of an identical [P_2O_5], at temp. >25°. R. T.

System oxygen–hydrogen–molten iron.—See B., 1940, 448.

Mutual system: monoammonium phosphate–sodium nitrate–water. I, II. S. J. SCHPUNT (J. Appl. Chem. Russ., 1940, **13**, 9—18, 19—28).—I. The solid phases forming in the system $NH_4H_2PO_4$ (I)–NaH_2PO_4 (II)–H_2O, at −10° to 30°, are (I), $NaH_2PO_4,2H_2O$ (III), and ice. The ternary cryo-

hydric point is at −12·1°, with (I) 8, (II) 26·6, and H_2O 65·4%.

II. The solid phases forming in the system $NaNO_3$–(II)–H_2O at −10° to 30° are $NaNO_3$, (III), and ice. The ternary cryohydric point is at −19·4°, with $NaNO_3$ 30·8, (II) 7·4, and H_2O 61·8%. R. T.

Surface energy of cadmium oxide and heat of formation of cadmium hydroxide. R. FRICKE and F. BLASCHKE (Z. Elektrochem., 1940, **46**, 46—49).—Dehydration of cryst. $Cd(OH)_2$ [pptd. from aq. $Cd(NO_3)_2$ by NaOH] at 350° or 800°, respectively, yields a greenish-yellow or a bluish-black form of CdO. The former has a mol. heat content (determined by dissolution in HF + HCl + H_3PO_4) 0·56 kg.-cal. > that of the latter. The two forms are shown by *X*-ray examination to differ only in particle size (190, >2500 A.), and the total surface energy of CdO is deduced to be ≮500 ergs per sq. cm. The heats of formation of $Cd(OH)_2$ from the two forms are 5·30 and 4·74 kg.-cal. per g.-mol., respectively. A. J. E. W.

Heats of formation of aluminium oxide (corundum) and lanthanum oxide. W. A. ROTH, U. WOLF, and O. FRITZ (Z. Elektrochem., 1940, **46**, 42—45).—Using Al of high purity and improved technique (ignition by Cellophane), the heat of formation of corundum is found to be 402·9±0·3 kg.-cal. per g.-mol., at 22° and const. pressure; the heat of formation of Al_4C_3 is then corr. to 50±3 kg.-cal. The val. for La_2O_3 is 539±4 kg.-cal., under similar conditions. La_2O_3 exists in two modifications, the form stable at low temp. having the higher mol. vol. A. J. E. W.

Heat of formation of chromic oxide. W. A. ROTH and U. WOLF (Z. Elektrochem., 1940, **46**, 45—46).—The heat of formation is 268·0±0·6 kg.-cal. per g.-mol. at ~20° and const. pressure. The val. for CrO_3 is deduced to be 137·1±0·4 kg.-cal., under similar conditions. A. J. E. W.

Calculation of ionic heat capacities in solution. D. H. EVERETT and C. A. COULSON (Trans. Faraday Soc., 1940, **36**, 633—643).—Methods of statistical mechanics are applied to the approx. calculation of the heat capacity change associated with the process $HA + H_2O = H_3O^{\cdot} + A'$. It is shown that the observed change is mostly accounted for by the influence of the ions on the freedom of rotation of H_2O mols. in their neighbourhood (cf. A., 1940, I, 73). F. L. U.

E.m.f. of Daniell's cells in molten salts. E. M. SKOBETZ and N. S. KAVETZKI (Mem. Inst. Chem. Ukrain. Acad. Sci., 1940, **6**, 149—162).—The e.m.f. of the cells Pb|5% $PbCl_2$||5% AgCl, $CuCl_2$ or $NiCl_2$|Ag, Cu or Ni (the solvent is fused KCl–NaCl–$SrCl_2$, at 600—800°) is conveniently measured using an unglazed porcelain diaphragm between the half-cells. The results obtained with glass diaphragms vary according to the type of glass used. The e.m.f. falls linearly with rising temp. R. T.

Oxidation–reduction potentials of complex ammoniates of platinum. A. A. GRÜNBERG, V. N. LAURENTIEV, and B. V. PTITZIN (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 52—53).—The oxidation–reduction potentials (E) at 25° of (*a*) $[Pt(NH_3)_3Cl]^{\cdot} + 2Cl' \rightleftharpoons [Pt(NH_3)_3Cl_3]^{\cdot} + 2e$, (*b*) $[Pt(NH_3)_2Cl_2] + 2Cl' \rightleftharpoons [Pt(NH_3)_2Cl_4] + 2e$ (*cis* and *trans*), (*c*) $[Pt(NH_3)Cl_3]' + 2Cl' \rightleftharpoons [Pt(NH_3)Cl_5]' + 2e$ have been measured using cells of the type $Hg|Hg_2Cl_2,KCl|KCl,KNO_3|R\text{-}Pt^{II}\ R\text{-}Pt^{IV}$, N-HCl|Pt$^{\cdot}$. E of the system $[Pt(NH_3)_4]^{\cdot\cdot} + 2Cl' \rightleftharpoons [Pt(NH_3)_4Cl_2]^{\cdot\cdot} + 2e$ was obtained by dissolving $[Pt(NH_3)_4]Cl_2$ in N-HCl, titrating with $KBrO_3$ until it was half oxidised, and keeping the mixture in a thermostat until a const. e.m.f. was obtained. E increases almost regularly with the no. of Cl in the complex ion. The vals. of E for the isomerides of (*b*) are nearly identical. W. R. A.

Oxidation–reduction potentials of quinones derived from carcinogenic hydrocarbons.—See A., 1940, III, 505.

Polarisation in deposition of bismuth at the cathode. O. ESSIN, M. LOSCHKAREV, Z. LEVITINA, and K. RUSANOVA (J. Appl. Chem. Russ., 1940, **13**, 56—65).—In the electrolysis of aq. $BiCl_3$ or $Bi(NO_3)_3$ polarisation is due chiefly to concn. differences, and may largely be eliminated by stirring. Residual polarisation appears to be connected with processes of corrosion and recrystallisation of the deposit. In the case of $Bi_2(SO_4)_3$ chemical polarisation is also evident, in the form of retardation of discharge of ions. Addition of colloidal solutions (sulphite lyes) increases polarisation. R. T.

Mechanism of aromatic side-chain reactions, with special reference to polar effects of substituents. X. Depolarisation potentials of *p*-substituted benzaldehydes in acid, neutral, and alkaline media at the dropping mercury cathode. J. W. BAKER, W. C. DAVIES, and (MISS) M. L. HEMMING (J.C.S., 1940, 692—702).—Depolarisation potentials of $p\text{-}C_6H_4R\cdot CHO$ (R = H, Me, Et, Pr^{β}, Bu^{γ}, Cl, OMe, NMe_2) have been measured polarographically in media of various p_H. It is confirmed that reduction occurs in two stages; the first, in acid and neutral solutions, requires 1 ***F*** and 1 atom of H per mol. of aldehyde, whilst the second occurs in acid, neutral, and alkaline media and also requires 1 ***F*** per mol. An explanation of the results is offered, on the basis of the relative importance of the combined polarisation and polarisability effects of the alkyl substituents (cf. A., 1939, I, 453). F. L. U.

Polarographic analysis of mixtures of aldehydes and peroxides.—See A., 1940, II, 264.

Mechanism of the exchange reaction between gaseous bromine and hydrogen bromide. W. F. LIBBY (J. Chem. Physics, 1940, **8**, 348).—Polemical against Liberatore and Wiig (A., 1940, I, 221). A bimol. mechanism is advanced. W. R. A.

Exchange reactions between gaseous alkyl bromides, bromine, and hydrogen bromide. L. C. LIBERATORE and E. O. WIIG (J. Chem. Physics, 1940, **8**, 349).—Gaseous Br_2 containing Br* shows no exchange when mixed with EtBr for ≯2 hr. Similar results have been found with HBr and EtBr. Exposure of a Br_2–EtBr mixture to the light of a 500-w. W lamp for 9 hr. at room temp. pro-

duced no exchange; at higher temp. exchange occurred. These results agree with an atom chain mechanism (A., 1940, I, 221). The bimol. mechanism postulated by Libby for the $HBr-Br_2$ exchange (preceding abstract) is criticised. W. R. A.

Exchange of oxygen between NO and NO_2. E. LEIFER (J. Chem. Physics, 1940, **8**, 301—303).—The exchange reaction $^{14}NO + {}^{15}NO_2 = {}^{15}NO + {}^{14}NO_2$ has been investigated at $-35°$ and at a total pressure of 2·5 cm. Hg. It is assumed that N_2O_3 is formed as an intermediate product. The reaction is very fast and a lower limit of the rate coeff. (k) is 10^6 c.c. mol.$^{-1}$ sec.$^{-1}$ The equilibrium const. is $0·96 \pm 0·02$ compared with the val. 0·967 calc. from spectroscopic data. The high val. of k indicates a small energy of activation for the formation of N_2O_3, probably <1 kg.-cal. The energy of activation for the dissociation of N_2O_3 into NO and NO_2 is ~10·5 kg.-cal. The exchange between NO and solid N_2O_3 (high content of ^{15}N) at $-118°$ has been investigated; solid N_2O_3 appears to be unstable and capable of existence only in equilibrium with its components. W. R. A.

Polymorphism. V. Linear rate of transformation of monoclinic into rhombic sulphur. P. G. ELIAS, N. H. HARTSHORNE, and J. E. D. JAMES (J.C.S., 1940, 588—595).—The linear rate of transformation of β- into α-S in polycryst. films at 20°, 30°, and 40° has been measured. In the case of a straight interface started by inoculation of the film edge the rate is const. at const. temp. up to a distance of 1·5 mm. The rate increases with increase in film thickness over the range 0·03—0·15 mm. The growth of nuclei in the interior of a film proceeds at const. rate in all directions in the plane of the film. The calc. apparent activation energy is ~15,000 g.-cal. C. R. H.

Hydrolysis of salts in solution. H. F. BROWN and J. A. CRANSTON (J.C.S., 1940, 578—583).—Continuing earlier investigations (cf. A., 1937, I, 245; 1938, I, 34), the p_H vals. and hydrolysis consts. of solutions of $ZnSO_4$, $Na_2C_2O_4$, $NaHCO_3$, KCl, K_2CrO_4, $K_2Cr_2O_7$, and $BeSO_4$ at various dilutions are recorded. In the case of salts which are only slightly hydrolysed it is essential that the solutions be guarded against contamination by atm. CO_2; a suitable apparatus for this purpose is described. C. R. H.

Sulphur iodide. I. Formation of sulphur monoiodide. II. Rate of decomposition and spectroscopic studies. M. R. A. RAO (Proc. Indian Acad. Sci., 1940, **11**, **A**, 162—174, 175—184).—I. When a CCl_4 solution of S_2Cl_2 is treated with dry solid KI, S monoiodide, S_2I_2, is formed. In dil. solution it has a yellow colour; it decomposes rapidly into S and I at room temp., but is stable at low temp. It undergoes photochemical decomp. and, with NaOH, yields compounds analogous to those obtained from S_2Cl_2.

II. The decomp. of S_2I_2 under various conditions has been investigated. The velocity of decomp. is not appreciably affected by the nature or extent of the surface. In conc. CCl_4 solutions the rate is > that in dil. solutions, and the rate at 30° is ~4 times that at 0°. S_2I_2 solutions absorb all λλ <4770 A. W. R. A.

Thionyl iodide. I. Formation of thionyl iodide. II. Rate of decomposition and spectroscopic studies. M. R. A. RAO (Proc. Indian Acad. Sci., 1940, **11**, **A**, 185—200, 201—205).—I. By shaking $SOCl_2$ in CCl_4 with solid KI at 0° SOI_2 is formed. It is very unstable and is readily decomposed, particularly by light. In the hydrolysis of SOI_2 with (a) NaOH, (b) aq. $CdCO_3$, (c) H_2O the following reactions occur: (i) $2SOI_2 \rightarrow S + SO_2 + 2I_2$; (ii) $SOI_2 + H_2O \rightarrow 2HI + SO_2$; (iii) $2SOI_2 + H_2O \rightarrow H_2S_2O_3 + 2I_2$; (iv) $S_2I_2 + 2H_2O \rightarrow H_2S + SO_2 + 2HI$, of which (i) and (ii) predominate. The % of each reaction for various conditions has been investigated. The amount of $Na_2S_2O_3$ formed when SOI_2 is hydrolysed is > with $SOBr_2$. $SOCl_2$ gives no $Na_2S_2O_3$.

II. SOI_2 (in CCl_4) is catalytically decomposed on the surface of KI and the rate of decomp. increases with temp. All λλ <5930 A. are absorbed by SOI_2. W. R. A.

Reaction between phosphorus and iodine in carbon tetrachloride solution. D. WYLLIE, M. RITCHIE, and E. B. LUDLAM (J.C.S., 1940, 583—587).—The reaction between P and I in CCl_4 where the amount of I is < that required to form P_2I_4 has been investigated. The reaction rate, k, increases with increasing [P], especially at high [P], *e.g.*, a seven-fold increase in $[P_4]$ gives approx. 160-fold increase in k when $[I_2] = 0·002$ mol. per l. The approx. constancy of k ratios for different [I] at const. [P] suggests that in the earlier stage I is being used in a secondary process apart from the disappearance of P. A six-stage chain mechanism involving the conversion of white into red P via P_4I_2 and the formation of P_2I_2 which reacts with I_2 to form P_2I_4 is suggested. Small quantities of MeOH, EtOH, $COMe_2$, Et_2O, and H_2O considerably increase k. With C_6H_6 and PhMe the increase is smaller, and there is no increase with $CHCl_3$, CS_2, C_6H_{14}, and *cyclo*hexane. Large increases in k are caused by those liquids in which I dissolves to a brown solution. A few experiments with P and Br are described. C. R. H.

Steric course of the hydrolysis of α-phenylethyl chloride in acetone containing mercuric chloride. D. R. READ and W. TAYLOR (J.C.S., 1940, 679—683).—The rate of change of rotatory power of CHPhMeCl in dry $COMe_2$ in presence of $HgCl_2$ is const. during any one run, and is independent of [CHPhMeCl] but ∝ $[HgCl_2]^2$. Addition of 5% of H_2O slightly increases the rate and this increase continues during the run. This increase has been traced to HCl formation. The rate of hydrolysis in 95% $COMe_2$ is const. at first but rapidly decreases. At the higher $[HgCl_2]$ the rate of racemisation and the initial rate of hydrolysis are the same, but at the lower concns. the latter is ≫ the former. Since, therefore, hydrolysis proceeds mord quickly than racemisation it cannot be subsequent to racemisation and the two mechanisms must be distinct. It is also shown that hydrolysis at first occurs with retention of configuration. The subsequent decrease in the rate of hydrolysis and the slight inversion of the final product show that in the later stages hydrolysis occurs with inversion. C. R. H.

Velocity of transformation of 1 : 3 : 5-triketones into 2 : 6-disubstituted γ-pyrones. I. Velocity of transformation of acetonedioxalic ester into chelidonic ester. S. S. DESHAPANDE, W. V. BHAGWAT, and C. W. SUBNIS (J. Indian Chem. Soc., 1940, **17**, 60—64).—The transformation of $CO(CH_2{\cdot}CO{\cdot}CO_2Et)_2$ into Et chelidonate in $COMe_2$ or aq. MeOH in presence of HCl is unimol. F. J. G.

Luminescence of luminol. E. BAUR (Helv. Chim. Acta, 1940, **23**, 449—454).—From measurements of the intensity of the luminescence emitted from an alkaline solution of luminol (3-aminophthalhydrazide) oxidised by H_2O_2 in presence of a trace of hæmin as catalyst, it is inferred that the reaction producing the luminescence is of the second order. It is identified with the bimol. decomp. of the activated form of an initially formed peroxide, with liberation of a mol. of O_2. Inhibitors (metol, quinol, cysteine hydrochloride, Na_2S, adrenaline, and ascorbic acid) are supposed to deactivate the peroxide to its ground state, in which it does not emit visible radiation on decomp. J. W. S.

Velocity of oxidation of molten iron with pure oxygen. M. S. FORTUNATOV and V. I. MICHAILOVSKAJA (Mem. Inst. Chem. Ukrain. Acad. Sci., 1940, **6**, 83—92).—The velocity of oxidation of Fe rises gradually from 1550° to 1650°, and very abruptly from 1650° to 1750°. The velocity appears to be determined at <1650° by that of diffusion of O_2 through the oxide layer, which is absent at >1650°. R. T.

Corrosion of metals and alloys.—See B., 1940, 456.

Rôle of ozone as an oxidation catalyst. Quantitative study of the effect of dilution of oxygen and ozone in the ozonisation of benzaldehyde and butaldehyde; evaluation of the length of the reaction chains. E. BRINER and G. PAPAZIAN (Helv. Chim. Acta, 1940, **23**, 497—513).—The effects of the $[O_3]$ and $[O_2]$ on the velocity of oxidation (v) of PhCHO and Pr^aCHO in CCl_4, C_6H_{14}, or *iso*-C_8H_{18}, and the consumption of these gases during the reaction have been investigated. At const. $[O_3]$ an increase in the $[O_2]$ increases v, the effect being most marked at low $[O_2]$. At const. $[O_2]$ the mol. ratio of O_2 and O_3 consumed increases with decreasing $[O_3]$, until for Pr^aCHO in O_2 containing 10^{-9}% of O_3 it is ~200,000. At const. $[O_2]$, v plotted against log $[O_3]$ yields a simple curve which can be used for the determination of very low $[O_3]$. J. W. S.

Stabilisation of hydrogen peroxide solutions.—See B., 1940, 489.

Catalytic action of 8-hydroxyquinoline on the oxidation of *p*-phenylenediamine. F. BERNHEIM and P. HANDLER (J. Amer. Chem. Soc., 1940, **62**, 984).—8-Hydroxyquinoline (I) catalyses the oxidation of p-$C_6H_4(NH_2)_2$ to a deeply coloured quinonediamine polymeride (reduced by $Na_2S_2O_4$ and hydrolysed by acid to NH_3) and further oxidation products. This reaction is unaffected by metals, CN', or P_2O_7'''', is fastest at p_H ~6·5 and much slower in alkali. (I) has no effect on the oxidation of o-$C_6H_4(NH_2)_2$, o- or p-$C_6H_4(OH)_2$ in acid or alkali, and little on that of p- or o-$NH_2{\cdot}C_6H_4{\cdot}OH$ at p_H 7·8. 2-Hydroxyquinoline and other quinoline derivatives are not catalysts. R. S. C.

Production of hydrogen by [catalytic] thermal decomposition of methane and of petroleum fractions.—See B., 1940, 441.

Influence of chemical activation of refractories on the combustion of fire-damp. M. B. RAVITSCH and B. A. ZACHAROV (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 65—68).—The kinetics of the combustion of a stoicheiometric ratio of H_2 and O_2 (initial pressure ~1 mm. Hg) on the surface of various refractories have been investigated from 100° to 950°. At low temp. and pressure the rate of combustion (k) of H_2 on the surface of chamotte brick is increased by impregnating the surface of the brick with oxides of Ni or Fe. Using Ural dunite k is > for activated chamotte. The val. of k at 400° with activated chamotte is equal to that for unactivated chamotte at 950°. W. R. A.

Velocity of hydrogenation of aromatic and unsaturated hydrocarbons. IV. A. V. LOZOVOI and M. K. DJAKOVA (J. Gen. Chem. Russ., 1940, **10**, 1—10).—The velocity of hydrogenation (Ni–Al_2O_3 catalyst; 40—70°/35 atm.) of a no. of hydrocarbons is, relative to $C_6H_6 = 1$, as follows: hexa-, very small, penta-, 0·005, tetra- 0·038, tri- 0·1, di- 0·22—0·34, and mono-alkylbenzene 0·4—0·5, $C_{10}H_8$ 3·3, *cyclo*hexene 150, 1-methyl- 5·1, and 3-methyl-*cyclo*hexene 134, *cyclo*pentene 294—470, Δ^a-hexene 306, styrene 900. R. T.

Catalytic synthesis of hydrocarbons.—See B., 1940, 427.

Catalytic effect of metals on ageing of lubricating oil.—See B., 1940, 425.

Action of vanadium catalysts in conversion of acetylene and water vapour into acetone.—See B., 1940, 428.

Catalytic cyclisation of aliphatic into aromatic hydrocarbons.—See B., 1940, 428.

Effect of animal charcoal on ascorbic acid.—See A., 1940, III, 595.

Theory of aqueous electrolysis. P. JOLIBOIS (Helv. Chim. Acta, 1940, **23**, 405—414).—The importance of the hydration of ions in solution and the orientation of the H_2O mols. in an electric field is discussed. It is suggested that the high mobilities of $H^{\cdot}$ and OH' ions arise through the circumstance that when they reach suitable positions relative to a H_2O mol. oriented in the electric field the ions react with the mol. forming a new ion. This leads to an immediate advance of 1·51 or 0·82 A. for $H^{\cdot}$ or OH' ion, respectively. In the cell $Pt,O_2|$electrolyte$|Pt,H_2$ it is supposed that the hydrate H_2O mols. orient themselves with the O and H atoms directed towards the H_2 and O_2 electrodes, respectively, thus permitting the gas on the electrodes to react with them and form new H_2O mols. During electrolysis of a salt solution it is supposed that when hydrated metal ions reach the cathode the metal oxide and at. H are formed, this being followed in some cases by reduction of the oxide by the at. H. This view explains the cathodic deposition of Ag_2O and Cu_2O by electrolysis

of suitable solutions, and also the formation of CuO and non-appearance of the Cu spectrum during electrolysis of aq. $CuSO_4$ with the cathode above the solution and making contact to it through an arc. Oxides are also deposited when an electrolyte solution is separated from the electrodes by distilled H_2O. When aq. KOH is electrolysed, using a cylindrical Fe cathode closed at the lower end by a thin mild steel plate, alkaline $Cu(OH)_2$ or $K_3Cu(CN)_4$ inside the Fe tube is reduced. This reduction is attributed to passage of the at. H through the steel. The theory is also discussed in relation to Faraday's laws of electrolysis. J. W. S.

Electrolytic separation of iodine from halide solutions and bore-hole water.—See B., 1940, 442.

Bismuth oxide as active material of the negative electrode in an alkaline storage cell.—See B., 1940, 460.

Electrometallurgy of antimony, bismuth, lanthanum, cerium, and praseodymium.—See B., 1940, 457.

Electrodeposition of chromium from potassium dichromate baths.—See B., 1940, 457.

Bath for electrolytic rhodium-plating of metals.—See B., 1940, 458.

Electrochemical nitration of hydrocarbons.—See B., 1940, 460.

Rôle of ozone as an oxidation catalyst. Sensitivity of the reactive aldehydes to post-photochemical reactions and to the presence of various materials, notably hæmin and nitric oxide. E. Briner and G. Papazian (Helv. Chim. Acta, 1940, **23**, 542—548).—The continuation of photochemical reaction chains after cessation of illumination can produce acidity in solutions of Pr^aCHO in CCl_4 of the same order as is produced by gases containing 10^{-5}—10^{-6}% of O_3. The first fractions obtained during the distillation of Pr^aCHO in N_2 are, however, free from this continued reaction. Hæmin causes an acceleration of the oxidation of Pr^aCHO, which at low $[O_3]$ is additive to the effect of the O_3. The effect on Pr^aCHO of the O_3 present in normal air is suppressed completely by the presence of 10^{-3}% of quinol in the solution, whilst 10^{-4}% has still a marked effect. Similarly 10^{-7}% of NO in the air has a strong retarding effect on the oxidation. J. W. S.

Photo-oxidation of sulphides. G. Calcagni (Annali Chim. Appl., 1940, **30**, 147—152).—ZnS, FeS_2, Sb_2S_3, and As_2S_3 in presence of H_2O at room temp. are oxidised to the corresponding sulphate on exposure to daylight. The effect with PbS is slight, whilst CuS and HgS are not oxidised. A method of analysis of Sb_2S_3 is described. F. O. H.

Photochemical analysis. G. Calcagni (Annali Chim. Appl., 1940, **30**, 153—156).—The hydrolysis of $CaCN_2$ and the oxidation of dil. aq. NH_3 to HNO_2 and HNO_3 (both systems in presence of MnO_2, Al_2O_3, Fe_2O_3, Cr_2O_3, TiO_2, SiO_2, or V_2O_5) are accelerated by exposure to daylight. F. O. H.

Poly-substituted sodium phosphomolybdates. E. A. Nikitina (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 370—371).—By treatment of aq. $Na_3H_4P(Mo_2O_7)_6,xH_2O$ with successive mol. quantities of NaOH, compounds of the type $Na_yH_zP(Mo_2O_7)_6,xH_2O$ are formed, where $y = 4$—11. Attempts to replace a twelfth H by Na lead to breakdown of the mol., as the solution becomes alkaline. J. W. S.

Alteration of metals by organic acids dissolved in non-aqueous liquids. R. Dubrisay (Compt. rend., 1940, **210**, 533—534; cf. A., 1939, I, 154).—The corrosion of Cu by PhMe and xylene solutions of stearic and palmitic acids in presence of H_2O is studied. The results suggest that the action of air and H_2O produces a sparingly sol. Cu compound, which reacts with the acid at the interface between H_2O and the org. liquid. Zn and Cd give similar results, but Al is not attacked. A. J. E. W.

Reduction of organic copper complexes by cold formaldehyde. P. Misciattelli (Atti X Congr. Internaz. Chim., 1938, IV, 689).—The systems $CuSO_4$–NaOH–tartrate and –glycerol were studied with respect to the conditions for pptn. of Cu or Cu_2O by CH_2O. F. O. H.

Isolation of rare earths from apatite.—See B., 1940, 441.

Removal of carbon dioxide from distilled water. F. Nydahl and H. Arnfelt (Svensk Kem. Tidskr., 1940, **52**, 17—19).—CO_2 is removed by aërating at reduced pressure, equilibrium vals. being obtained after passing 2·7 l. of air in 40 min. at 20 mm. Hg. At 760 mm. Hg equilibrium is attained only after passing 6 l. of air per min. for 120 min. M. H. M. A.

Lead etching effect. J. A. Smythe (Nature, 1940, **145**, 704).—When polished surfaces of some ancient leads containing inclusions of PbO are etched with boiling, dil. HCl, dendritic crystals of Pb appear at the junction of Pb and PbO, and grow outwards from the Pb during the etching process. This is due to pptn., during etching, of Pb from the solution of $PbCl_2$ formed. L. S. T.

Carbonyls of group VI metals. I. K. A. Kotscheschhov, A. N. Nesmejanov, M. M. Nadj, I. M. Rossinskaja, and L. M. Borisova. **II.** K. N. Anisimov and A. N. Nesmejanov (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 54—57, 58—59).—I. Reduction of WCl_6 and $MoCl_5$ at −10° to 0° by CO and Fe or Zn dust in $Et_2O + C_6H_6$ yields $M(CO)_6$. Improved yields of $W(CO)_6$ and $Mo(CO)_6$ were obtained respectively in dry Et_2O and $COMe_2$. The intermediate formation of a sub-halide, unstable at low temp., is tentatively advanced to explain, *inter alia*, the low yields of ~10—14%.

II. Increased initial pressures of CO improve the yields of $W(CO)_6$ and $Mo(CO)_6$. $W(CO)_6$ can also be prepared from $WOCl_4$ in Et_2O by the method given above. Carbonyls could not be prepared from WO_3 or from $CrCl_3$. W. R. A.

Separation of uranium isotopes. W. Krasny-Ergen (Nature, 1940, **145**, 742—743).—A procedure

for separating ^{235}U, based on the thermal diffusion method of Clusius and Dickel (A., 1939, I, 224) and using UF_6, is described. L. S. T.

Complex compounds of platinum with complex amines. II. A. M. RUBINSCHTEIN (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 372—375).—5-Bromo-2-aminopyridine (I) (2 mols.) with K_2PtCl_4 (1 mol.) in aq. EtOH yields after 2—3 hr. a ppt. of the *complex* $PtCl_2,2(I)$, readily sol. in C_5H_5N giving a solution which deposits crystals of $(C_5H_5N)_2PtCl_2$ (II). When treated with $CS(NH_2)_2$ (4 mols.), (II) (1 mol.) yields the *complex* $(C_5H_5N)_2\{CS(NH_2)_2\}_2,PtCl_2$, indicating the *trans*-configuration of (II). 5-Chloro-2-aminopyridine (III) and K_2PtCl_4 in aq. EtOH react very slowly, with deposition of a light green ppt. of the *complex* $PtCl_2,2(III)$, which when heated with C_5H_5N on the H_2O-bath yields (II). Chloropyridine (IV) and K_2PtCl_4 in aq. EtOH react extremely slowly and after several days deposit a ppt. of the *complex* $PtCl_2,2(IV)$ (V). On passing Cl_2 through an aq. suspension of (V) an orange deposit of the *complex* $PtCl_4,2(IV)$ is obtained. When heated with C_5H_5N, (V) dissolves, but no ppt. deposits; on addition of K_2PtCl_4, however, a light pink ppt. of $[(C_5H_5N)_4Pt][PtCl_4]$ is produced. When the solution is evaporated in a desiccator a white ppt. of $4C_5H_5N,PtCl_2,3H_2O$ is deposited, whilst addition of EtOH and Et_2O to such a solution gives a ppt. of $4C_5H_5N,PtCl_2$. When dried this loses C_5H_5N and yields $2C_5H_5N,PtCl_2$. J. W. S.

Electro-capillary method of qualitative analysis. S. I. DJATSCHKOVSKI and A. F. ORLENKO (J. Gen. Chem. Russ., 1940, **10**, 82—96).—An analytical procedure is described. R. T.

Identification of perchlorate, persulphate, and some other inorganic acid residues with Zwikker's reagent. Sensitive reaction for copper. G. H. WAGENAAR (Pharm. Weekblad, 1940, **77**, 465—468).—Characteristic microcryst. ppts. are obtained with Zwikker's reagent ($CuSO_4$–C_5H_5N) and ClO_4' (1 : 100), S_2O_8'' (1 : 1000), S_2O_3'' (1 : 1500), CrO_4'' (1 : 300), and MnO_4'' (1 : 3000), the sensitivity being given in parentheses. Amorphous ppts. are obtained with I′, CN′, CNS′, and molybdate. $Cu^{\cdot\cdot}$ (1 : 25,000) can be detected by adding a drop of C_5H_5N and N-$KMnO_4$. S. C.

Sensitive test for iodide and nitrite. C. L. WILSON (Chem. and Ind., 1940, 378).—One drop of 2N-AcOH is placed on test paper, and a drop of test solution, followed by 1 of 0·1N-KNO_2, is allowed to run from a capillary on to its centre. A blue ring shows the presence of I′; limit of identification, 0·025 μg. Many brands of paper sold for drop reaction tests contain sufficient starch to give the starch–I′ colour. L. S. T.

Determination of iodine in soils, plant material, and water.—See B., 1940, 475.

Photocolorimetric determination of fluorine in air, by means of zirconium–alizarin. M. M. RAINES and S. V. KAZATSCHKOVA (J. Appl. Chem. Russ., 1940, **13**, 153—156).—5 l. of air are aspirated through two paraffined wash-bottles, each containing 10 ml. of H_2O. The solution is transferred to a cylinder, and 0·5 ml. of indicator [0·034% Na alizarin-sulphonate in 0·174% $Zr(NO_3)_4$], 0·5 ml. of 3N-H_2SO_4, and 0·5 ml. of 3N-HCl, and H_2O to 25 ml. are added. The resulting coloration is compared with that given by a series of standards. The method serves for determination of 1—20 μg. F. R. T.

Rapid determination of oxygen in steel.—See B., 1940, 451.

Starch iodide method of ozone analysis. C. E. THORP (Ind. Eng. Chem. [Anal.], 1940, **12**, 209).—Addition of an $AlCl_3$ + NH_4Cl buffer solution increases the sensitivity of the KI reaction from 0·0013 to 0·00062 mg. of O_3 per c.c. of 2N-KI, without introducing the error caused by acidifying the KI. The buffered KI solution is stable for 3 hr. in light, and for >40 hr. in the dark. Precautions to be observed in removing H_2O_2 and oxides of N, and in preventing decomp. of the O_3, are discussed. L. S. T.

Colorimetric micro-determination of sulphur in gases.—See B., 1940, 421.

Rapid simultaneous determination of sulphur and chlorine in coal and coke.—See B., 1940, 419.

Determination of selenium in glass.—See B., 1940, 443.

Determination of tellurium in tin-rich alloys.—See B., 1940, 453.

Potentiometric determination of hydroxylamine and hydrazine in alkaline solution. H. T. S. BRITTON and (MISS) M. KÖNIGSTEIN (J.C.S., 1940, 673—676).—NH_2OH and N_2H_4 can be determined by potentiometrically titrating solutions of alkaline Cu tartrate or ammoniacal $CuSO_4$ at 90°, using bright Pt foil or Cu as indicator electrode. NH_2OH is oxidised to N_2O and N_2H_4 to N_2. It is preferable to carry out the titrations in N_2. Beyond the end-point the Pt electrode functions as a Cu electrode in equilibrium with $Cu^{\cdot\cdot}$, the electrode acquiring a coating of Cu as a result of the reduction of Cu_2O. C. R. H.

Spectral determination of arsenic, antimony, bismuth, and tellurium in lead.—See B., 1940, 453.

Test for arsenic in lead alloys.—See B., 1940, 453.

Determination of silicon in aluminium–silicon alloys.—See B., 1940, 455.

Rapid determination of silicon in iron and steel.—See B., 1940, 450.

Determination of silica and R_2O_3 in Portland cement.—See B., 1940, 446.

Detection of traces of carbon monoxide in gas mixtures.—See B., 1940, 421.

Determination of carbonate in small amounts of [building] materials.—See B., 1940, 446.

Determination of small amounts of cyanide in water.—See B., 1940, 502.

Determination of free sodium cyanide in brass-plating solutions.—See B., 1940, 457.

Colorimetric micro-determination of sodium. B. T. MULWANI (J. Univ. Bombay, 1940, [ii], **8**, 128—

134).—An extract containing Na (0·01—0·60 mg.) is diluted to 2 c.c., and stirred with 4 c.c. of Zn uranyl acetate reagent until crystallisation begins. After keeping for 1 hr. at 0° the mixture is centrifuged. The ppt. is washed with ice-cold EtOH saturated with Na Zn uranyl acetate and is then dissolved in H_2O, treated with glacial AcOH (1 drop) and 20% aq. $K_4Fe(CN)_6$ (0·5 c.c.), and made up to 25 c.c. The colour developed after 1 min. is compared with standards. Ca, Mg, Fe, Al, and Mn or HCl (>2N.) do not interfere with the determination. Large amounts of K may be removed by pretreatment with $HClO_4$. J. W. S.

Rapid micro-determination of silver by a method based on colloid colorimetry. C. G. Makris and R. Menaché (Ann. Chim. Analyt., 1940, [iii], **22**, 117—120).—The solution containing Ag is evaporated to dryness and the residue dissolved in H_2O (2 c.c.). Fresh 0·5% tannin solution (4 c.c.), 0·1N-NaOH (0·18 c.c.), and aq. Na albuminate (2 drops) are added. After 5 min. the colour produced is compared colorimetrically with standards prepared at the same time and containing 0·25, 0·5, and 1·0 c.c. of 0·01N-$AgNO_3$. Colour comparison is facilitated by using filters containing an aq. solution of gentian-violet and methylene-blue. The Na albuminate is prepared by dissolving fresh egg-white (5 c.c.) in 0·1N-NaOH (100 c.c.). To determine Ag in galena, the sample (0·2—0·3 g.) is ground finely and treated with HNO_3. After evaporating twice to dryness the residue is treated with 10% K_2SO_4 (2 c.c.), H_2O (3 c.c.), and 95% EtOH (5 c.c.). The $PbSO_4$ is separated, washed with EtOH, and the solution and washings are evaporated, treated with H_2O (10 c.c.) and aq. NaOAc, filtered, and made up to 25 c.c. 2 c.c. of this solution are taken for the colorimetric test. J. W. S.

Limits of identification of simple confirmatory tests. A. A. Benedetti-Pichler and J. R. Rachele (Ind. Eng. Chem. [Anal.], 1940, **12**, 233—241).—The ultimate limits of identification of the test for $Ba^{\cdot\cdot}$ by addition of SO_4'' and for $Fe^{\cdot\cdot\cdot}$ by the formation of Prussian-blue have been investigated. Using the micro-manipulators and micro-injection apparatus described, drops of 10^{-9}—10^{-11} ml. of test solution and reagents were deposited in a film of paraffin oil and examined microscopically. With a ×397 magnification and dark-field illumination, 10^{-14} g. of $Ba^{\cdot\cdot}$ from 10^{-9} ml. of 0·001% $BaCl_2$ always gave positive results. With the same magnification and transmitted light, the Prussian-blue test was positive with 4×10^{-13} g. of $Fe^{\cdot\cdot\cdot}$ in 4×10^{-11} ml. of test solution. These results agree with theoretical conclusions. Factors determining experimental limitations are discussed. Under the best practical conditions, limits of identification are determined mainly by the increase in solubility with a decrease in particle size of ppts., the inherent intensity of a coloration, and limits of microscopic visibility, with the concn. sensitivity of the test playing a decisive part. L. S. T.

Colorimetric micro-determination of magnesium. C. P. Sideris (Ind. Eng. Chem. [Anal.], 1940, **12**, 232—233).—Hoffmann's method (A., 1937, III, 165) has been modified by extracting the Fe^{III}-8-hydroxyquinoline compound with $CHCl_3$ and diluting to the required vol. with BuOH. Details of procedure and typical results for 0·1—1·0 mg. of Mg are recorded. The Al, Pb, Fe, Zn, Mn, and Cu are removed with 8-hydroxyquinoline before the $FeCl_3$ is added to the Mg salt. L. S. T.

8-Hydroxyquinoline as a reagent for the determination of magnesium, especially in carbonate and silicate rocks. (Miss) C. C. Miller and I. C. McLennan (J.C.S., 1940, 656—659).—To 100 ml. of solution (≡10—50 mg. of MgO) are added NH_4Cl 2 g. and *o*-cresolphthalein (0·02% in EtOH) 0·5 ml. After addition of 6N-NH_3 (2 ml. > the amount necessary to attain p_H 9·5) the solution is heated to 70—80° and, according as the amount of Mg is large or small, a 5% or 1% solution of 8-hydroxyquinoline (I) in AcOH (2N. and 0·4N. respectively) is very slowly added with stirring until pptn. is complete and the supernatant liquid is deep yellow. The ppt. is digested at 100° for 10 min., collected, washed with hot H_2O, and dried at 105° [(I)-free ppt.] or at 160° [(I)-contaminated ppt.] for a few hr. The method is applicable to the determination of Mg in rocks after removal of Ca (as oxalate), Al, Fe, Mn, and SiO_2. The method affords fair accuracy but the Mg pptn. is very susceptible to changes in conditions. C. R. H.

Quantitative spectrochemical analysis by measurement of relative intensities. E. K. Jaycox and A. E. Ruehle (Ind. Eng. Chem. [Anal.], 1940, **12**, 195—196).—The method described combines flexibility of application with the improved precision resulting from modern photometric methods. Representative analyses in which an impurity in Pb, Al, Fe, Cu, Ni, or alkaline-earth oxide is determined with an accuracy of 5—10% are recorded. L. S. T.

Determination of lead in "ethyl" petrol.—See B., 1940, 424.

Polarographic determination of small amounts of copper in aluminium.—See B., 1940, 455.

Assay of mercurial ointments.—See B., 1940, 491.

Determination of aluminium by photometric fluorescence measurement. C. E. White and C. S. Lowe (Ind. Eng. Chem. [Anal.], 1940, **12**, 229—231).—The intensity of fluorescence of the Al–morin reaction is measured by means of the Pulfrich or photo-electric photometer. The amounts of morin and EtOH, the temp., and p_H required to obtain max. intensity are defined. Details of procedure and typical results (accuracy ~3%) for 0·01—0·005 mg. of Al per ml. are recorded. Interference by certain anions and cations is discussed. L. S. T.

Determination of manganese, magnesium, and lead in aluminium alloys containing lead.—See B., 1940, 455.

Titrimetric determination of ferric oxide and alumina in soil extracts.—See B., 1940, 475.

Systematic utilisation of atomic groups in analytical chemistry. XI. Relation between

constitution and analytical properties. J. V. DUBSKÝ (Mikrochem., 1940, **28**, 145—172).—Mainly a review (cf. A., 1939, I, 40, 157, 217, 429, 430). The following is new. Pure $NH_2{\cdot}CS_2H$ gives red Ni, brown Cu, and green Co salts (cf. lit.). H_2CS_3 gives a red Ni salt, + $3NH_3$. $(NMe_2{\cdot}CS{\cdot}S)_2$ (I) gives *salts*, 3X,4CuCl·OH, m.p. 203°, 3X,3NiCl·OH, m.p. 139°, 3X,2CoO, m.p. 315—320°, and 3X,2Co$(OH)_3$, m.p. 310—315°. $(NMe_2{\cdot}CS)_2S$ [prep. from (I) by KCN] gives *salts*, 3X,4CuCl·OH, m.p. 204°, and 3X,2Co$(OH)_3$, m.p. 315°. $SH{\cdot}CH_2{\cdot}CO_2H$ gives a *salt*, $Cu^{I}S{\cdot}CH_2{\cdot}CO_2{\cdot}Cu^{II}{\cdot}OH$. $SH{\cdot}C(N{\cdot}OH){\cdot}CO_2H$ gives *salts*, $Fe_3[S{\cdot}C(N{\cdot}OH){\cdot}CO_2H]_3$, $SH{\cdot}C(N{\cdot}OH){\cdot}CO_2Ba(OH)_2Ba{\cdot}O{\cdot}CO_2H$, + H_2O, and $OH{\cdot}Fe[S{\cdot}C(N{\cdot}OH){\cdot}CO_2BaCl]_2,18H_2O$. Fission of oximino-ψ-thiohydantoin (II) by NH_3 leads to a *salt*, $[Fe(NH_3)_4S{\cdot}C(N{\cdot}OH){\cdot}CO_2NH_4](OH)_2,4H_2O$, and by KOH to the *salt*, $[OH{\cdot}N{:}C(CO_2H)S]_2Fe(OH)_2Fe[OH{\cdot}N{:}C(CO_2H)S]_2,4H_2O$. (I) gives a simple N-*Ag* salt, but complex Ba and Ca diol-salts. 2-Thiohydantoin–$NO{\cdot}C_6H_4{\cdot}NHPh$ (A., 1939, I, 430) should read 2-thiohydantoin–$NPh_2{\cdot}NO$. Ag salts of $CS(NH{\cdot}NHPh)_2$ and $NPh{<}^{CO{\cdot}C{:}N{\cdot}NHPh}_{N{=}C{\cdot}CO_2H}$, a Cr_2 diol-salt of $NHPh{\cdot}CH_2{\cdot}CO_2H$, Hg salt of $NO{\cdot}NPh{\cdot}CO_2H$ (sensitivity 6·4 μg. at 1 : 4700), various salts of o-$CO_2H{\cdot}C_6H_4{\cdot}NH{\cdot}CH_2{\cdot}CO_2H$, gallocyanine, and carminic acid (cf. A., 1930, 182), and 1-thiolbenzthiazole are noted. Condensation of $NPh_2{\cdot}NO$ with 2-thiohydantoin to a *product*, m.p. >350° (complex *Ag* salt), and with rhodanine to a *product*, +$2COMe_2,H_2O$, m.p. ~50°, are described R. S. C.

Conductometric analysis of chrome liquors.—See B., 1940, 441.

Rapid determination of chromic oxide in chrome tanning extracts.—See B., 1940, 472.

Application of pyrrole to detection of certain ions by drop reactions. R. L. DREMLIUK (J. Appl. Chem. Russ., 1940, **13**, 157—160).—When a drop each of solution, of 1% pyrrole in EtOH, and of 2N-HCl or conc. H_3PO_4 are placed on filter-paper, a blue or green coloration appears in presence of ≮ the following amounts of ions: $Au^{\cdots}$ 3, VO_3' 0·8, MoO_4'' 34, MnO_4' 10, Cr_2O_7'' 5, IO_3' 0·16, BrO_3' 40, IO_4' 5, NO_2' 18, $[PO_4,12MoO_3]'''$ 18 μg. In these conditions $Hg^{\cdot}$ (≮ 4 μg.) gives a ppt. of Hg, but no coloration. R. T.

Determination of gold in auriferous material.—See B., 1940, 453.

Assay for platinum metals in ore concentrates.—See B., 1940, 453.

Heat control units. J. A. RIDDICK (Ind. Eng. Chem. [Anal.], 1940, **12**, 222—224).—Control panels of two or more autotransformers are described. The autotransformer permits precise adjustment of the jacket temp. of fractionating columns, and of the rate of boiling of solvents. L. S. T.

High-temperature laboratory furnaces. M. PIRANI (J. Sci. Instr., 1940, **17**, 112—115).—A tube furnace comprises a tube prepared from finely ground commercial BeO with a winding of 0·8-mm. Mo wire, The tube and heater are enclosed in an Fe casing, packed with BeO slabs and Al_2O_3 tubes, through which H_2 is led. A second type of furnace utilises spiral filaments of 1-mm. W wire, supported at the ends by Mo rods which pass through holes in the limbs of U-shaped pieces of Zr silicate bricks, which, together with rectangular bricks of the same material, form the furnace lining. The furnaces described have been operated at 1950° and 1900°, respectively. J. W. S.

Device for investigating volatile and liquid substances in the micro-m.p. apparatus. R. FISCHER (Mikrochem., 1940, **28**, 173—182).—The device enables m.p. and n to be determined. R. S. C.

Windows for studying the optical properties of hydrogen fluoride gas. B. VODAR, R. FREYMANN, and YEOU TA (J. Chem. Physics, 1940, **8**, 349).—Using a Duroid window a wide and weak band near 0·93 μ. has been found for ~ 40% aq. HF solution. Org. glasses and CaF_2 are attacked by conc. HF solutions and by gaseous and liquid HF but white corundum is unattacked by the gas even at high temp. and shows no absorption bands between 1850 A. and 2·5 μ. W. R. A.

Refractive index liquids. V. L. BOSAZZA (Amer. Min., 1940, **25**, 299—301; cf. A., 1934, 749).—Data for n of various kerosene (I) fractions are given. Only the best grades of (I) yielding distillates of fairly pleasant odour should be used. 1-$C_{10}H_7Br$–$AsPhI_2$–kerosene fraction gives the best set of mixtures for n 1·44—1·85; these mixtures are stable. L. S. T.

Systematic qualitative organic micro-analysis. Determination of the refractive index of liquids. H. K. ALBER and J. T. BRYANT (Ind. Eng. Chem. [Anal.], 1940, **12**, 305—307).—The micro-refractometer described consists of two small glass prisms of the same n cemented together in opposition in a small metal ring on a microscope slide. The ring is filled with the test liquid (~8 cu. mm.) and the double deviation of the light beam is measured with a microscope; it ∝ the difference in n between glass and liquid. Reference to a prepared calibration curve gives n directly. By use of two cells, one with prisms n 1·52 and the other n 1·75, the range n 1·33—2·0 may be covered with a precision of ±0·001. The test liquid may be recovered. J. D. R.

Increase of light intensity in optical apparatus. A. SMAKULA (Z. Instrumkde., 1940, **60**, 33—36; cf. Blodgett, A., 1939, I, 238).—Reflexion of light at glass–air surfaces can be eliminated by the deposition on the surface of a thin film of $n = \sqrt{n_g}$, and thickness $x\lambda/4(n_g^2 - \sin^2\alpha)^{\frac{1}{2}}$ (n_g, refractive index of glass; x, an integer; λ, wave-length of incident light; α, angle of incidence of light). O. D. S.

Lumino-microscopic methods. A. A. SCHISCHLOVSKI (Mém. Physique, Kiev, 1940, **8**, 155—159).—A fluoro-phosphoroscope is described. R. T.

Recording microphotometer. H. LLOYD and E. M. GUÉNAULT (J. Sci. Instr., 1940, **17**, 103—111).—In the instrument described, the plate or film under examination rests on a moving horizontal stage

driven by a governor-controlled clock and coupled to a recording drum. The optical system is vertical and employs a photo-electric cell connected directly to a taut-suspension reflecting galvanometer, the deflexions of which are recorded photographically on the revolving drum. The instrument has been used for the measurement of spectroscopic and *X*-ray diffraction negatives, and as a recorder in the survey of low illuminations by photographic photometry. J. W. S.

Neutral wedge abridged spectrophotometer. P. A. CLIFFORD and B. A. BRICE (Ind. Eng. Chem. [Anal.], 1940, **12**, 218—222).—An improved form of spectrophotometer (cf. A., 1936, 443), and monochromatic filters are described. The use of the instrument for determining the concn. of coloured solutions by reference to standard curves is detailed, and various applications are mentioned. L. S. T.

Thermionic relay. H. M. WADDLE and W. SAEMAN (Ind. Eng. Chem. [Anal.], 1940, **12**, 225).—The relay described can be used with any apparatus in which the current in the control circuits must be kept low in order to avoid sparking or corrosion of electrical contacts. L. S. T.

Coincidence counting in a β-particle spectrograph. N. FEATHER (Proc. Camb. Phil. Soc., 1940, **36**, 224—235).—The β-particle spectrograph described embodies a counting circuit designed to record coincidences between electrons of a fixed energy and particles of widely varying energy, with a resolving time 10^{-6} sec. The possibility of using such an instrument to investigate the correlation between the natural β-ray lines of a source and portions of the continuous spectrum corresponding with different modes of transformation is examined. L. J. J.

Demonstration of thermal diffusion in liquids. D. TAYLOR and M. RITCHIE (Nature, 1940, **145**, 670).—Apparatus for demonstrating the Clusius–Dickel thermal diffusion effect (A., 1939, I, 224) in aq. $CuSO_4$, aq. $CuBr_2$, or acid (HCl) $CoCl_2$ is described. L. S. T.

Thermal diffusion separation of different gases of the same mol. wt. F. T. WALL and C. E. HOLLEY, jun. (J. Chem. Physics, 1940, **8**, 348).—Using a 9-ft. thermal diffusion column (described), separation of the components of the following mixed gases has been effected: CO_2–C_3H_8; CO_2–N_2O; CO–C_2H_4; N_2–C_2H_4. No separation occurred with CO–N_2 mixtures. Since separation occurs other factors, *e.g.*, structure and forces of attraction and repulsion, must influence the diffusion process as well as thermal effects. Usually the larger mols. are conc. at the bottom of the column. W. R. A.

Efficiency of the thermal diffusion process for separating isotopes. J. W. WESTHAVER and A. K. BREWER (J. Chem. Physics, 1940, **8**, 314—316).—Mathematical. The theory of Gillespie (A., 1939, I, 463) is extended to include other factors in the separation process. An ideal system of cells having temp. limits of 3000° and 500° K. requires $\not<$880 kw.-hr. of conducted heat per g. of $^{13}CH_4$ extracted to a concn. of 20%. W. R. A.

Deposition of thin metallic films by cathodic sputtering. V. VOSS and M. N. S. IMMELMAN (J. Sci. Instr., 1940, **17**, 116). A strip of Al foil, fitted around the inside of the shoulder of the bell-jar, and a horizontal disc of the metal to be sputtered carried on a glass-covered Al wire fitted axially through the top of the jar, are used as electrodes. The plate on which the film is to be sputtered is placed below the disc and out of the path of the discharge. J. W. S.

Self-seating valve. J. H. MARVELL (J. Sci. Instr., 1940, **17**, 115—116).—The valve comprises a screwed spindle with a very fine thread, carrying at its lower end a hardened stainless steel ball fitting into a suitably bored seating. This seating is made with a sharp edge so that the ball moulds it when first screwed down. The valve requires very little attention and has been used for high vac. and for pressures $\not>$120 atm. J. W. S.

Flow meter for slow rates of flow. A. E. L. MARSH (Trans. Faraday Soc., 1940, **36**, 626).—The instrument described measures (gas) flow rates ~1—0·25 c.c. per min., and the readings are independent of the η of the gas. F. L. U.

Simple manometer for the measurement of total pressure. C. WEISS and H. WESTMEYER (Z. Instrumkde., 1940, **60**, 53—54).—A hot-wire manometer, with temp. measurement by a thermocouple, for pressures down to 10^{-5} mm. is described. O. D. S.

Accelerated sublimation. A. J. BAILEY (Ind. Eng. Chem. [Anal.], 1940, **12**, 194—195).—Cold air is passed through a heated flask (+ substance) fitted with a simple distillation head. The method is quicker and more convenient than ordinary or vac. distillation. β-$C_{10}H_7$·OH sublimed at the rate of ~1 g. per min. to give a pure product. L. S. T.

Removal of adhered rubber stoppers. F. A. ROBINSON (Ind. Eng. Chem. [Anal.], 1940, **12**, 224; cf. A., 1940, I, 176).—The glass rod is separated by means of a lubricated cork borer. L. S. T.

Apparatus for continuous automatic measurement of evolved gas. M. L. CROSSLEY, R. H. KIENLE, and C. H. BENBROOK (Ind. Eng. Chem. [Anal.], 1940, **12**, 216—217).—Apparatus for recording N_2 evolved from the decomp. of diazo-compounds by solvents is described, and its use illustrated by reference to the decomp. of PhN_2Cl by H_2O at 35°. It can also be used to record the rate of sedimentation of suspensions, and to determine rates of distillation. L. S. T.

Modified form of the standard falling-sphere viscosimeter.—See B., 1940, 417.

Apparatus for rapid determination of carbon and sulphur in ferrous products.—See B., 1940, 451.

New method of gas analysis.—See B., 1940, 421.

Geochemistry.

Waters from the calcareous massif of the Ouarsenis (Algeria). L. CALEMBERT (Compt. rend., 1940, **210**, 630—632).—Analyses of 15 subterranean waters are correlated with the tectonic character of the deposits. A. J. E. W.

Fluorine in the waters of the Chibina region. V. V. DANILOVA (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 230—231).—The F contents recorded for the rivers and lakes of this region show that the % F differs little from that of other rivers, and that enrichment from the fluorapatite is low. The ratio F/dry residue is high. L. S. T.

Fluorine in the underground waters of the Chibina region. I. N. ZAVIALOV (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 232—233).—The F contents and p_H of surface and underground H_2O of the Bolshoy and Maly Vudyavr lakes are recorded. The surface H_2O generally contains less F and has a lower p_H. L. S. T.

Radium, vanadium, chromium, and molybdenum contents of the hot springs of Yunohanazawa and their seasonal variations. K. KURODA (Bull. Chem. Soc. Japan, 1940, **15**, 65—70).—Analytical results are given. F. J. G.

Analysis of the meteorite "Saratov." L. S. SELIVANOV (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 389—392).—The non-magnetic fraction of a meteorite which fell in Saratov in 1918 contained SiO_2 44·83, FeO 14·46, and MgO 27·43%, with smaller amounts of Ti, Al, Cr, Ca, Mn, Na, K, P, and S. The magnetic fraction contained Fe 68·1, Ni 8·9, MgO 6·28, and SiO_2 10·53%, together with small amounts of other elements. J. W. S.

Magmatic gases. T. A. JAGGAR (Amer. J. Sci., 1940, **238**, 313—353).—Chemical analyses of numerous samples of gases collected in vac. tubes from liquid lava from Kilauea, Hawaii, are recorded, and discussed in relation to quality, to volcanic as opposed to atm. gaseous constituents, etc. L. S. T.

Method for distinguishing quartz and untwinned felspar with the universal stage. D. J. DOEGLAS (Amer. Min., 1940, **25**, 286—296).—A rapid and trustworthy method for determining quartz and untwinned felspar in mineral grains or thin sections is described. L. S. T.

Felspars from the mica pegmatites of Nellore, Madras. N. JAYARAMAN (Proc. Indian Acad. Sci., 1940, **11, A**, 116—137).—A detailed account of work already noted (A., 1938, I, 644). W. R. A.

Propylitisation and related types of alteration on the Comstock Lode. R. COATS (Econ. Geol., 1940, **35**, 1—16).—The Comstock district shows three types of alteration of the original pyroxene-andesite; these are (i) deuteric, due probably to H_2O vapour present in the rock at the time of its crystallisation, (ii) propylitic, due probably to heated solutions given off by a later intrusive, and (iii) zeolitic, due probably to vein-forming agencies. The usual explanations of propylitisation, viz., dynamometamorphism, autohydration, and action of vein-forming solutions, are not applicable. L. S. T.

Pegmatites of the Spruce Pine district, N. Carolina. C. S. MAURICE (Econ. Geol., 1940, **35**, 49—78).—Numerous pegmatites are classified and described. In general, plagioclase predominates over microcline and crystallised first. Much of the commercial mica is primary. Accessory minerals include compounds of Nb, U, and the rare earths. L. S. T.

Metamorphism and assimilation in the Wellington district, New South Wales. I. Hybridisation in the Wuuluman Creek intrusion. E. M. BASNETT (J. Proc. Roy. Soc. New South Wales, 1939, **73**, 161—189).—Petrography is described and petrogenesis discussed. The Wuuluman Creek mass consists of two separate intrusive types; the younger, a keratophyre (I), has invaded an earlier mass of dolerite and produced zones of hybrid rocks. The mineralogical changes in the hybrid rocks are due to the introduction of sodic magma (I), followed by the injection of a (I) richer in K_2O. Chemical analyses are recorded. L. S. T.

Fluorescence spectrum and composition of scapolite. E. IWASE (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1940, **37**, 58—64).—Investigation of the fluorescence spectra of scapolites from North Burgess (Ontario) and Grenville (Quebec) shows that U is probably the effective activator. There are, however, differences in the positions of the U bands according to locality. Scapolite may be supposed to be the result of isomorphous combination of meionite, $Ca_4Al_6Si_6O_{25}$ (I), and marialite, $Na_4Al_3Si_9O_{24}Cl$. Determinations of face angles, n, and d show that North Burgess scapolite contains between 36 and 42 mol.-% of (I), whilst Grenville scapolite contains 70 mol.-% of (I). The difference in composition explains the variation in position of the U bands. A. J. M.

Secondary mineralogical modifications in the phlogopite deposit at Volonandrongo (west of the central massif of Madagascar). A. LACROIX (Compt. rend., 1940, **210**, 425—429).—The deposits, which include phlogopite, diopside, dipyre, apatite, sphene, molybdenite, actinote, byssolite, tremolite, asbestos, albite, clinozoisite, tourmaline, and heulandite, are described in detail and their formation is compared with that of deposits in the extreme south of Madagascar (cf. A., 1940, I, 237). A. J. E. W.

Photo-luminescence of scheelites. M. SERVIGNE (Compt. rend., 1940, **210**, 440—442).—The approx. Pr, Nd, Sm, Eu, Gd, Tb, Dy, and Er contents of 15 scheelites have been determined by the photo-luminescence method (cf. A., 1937, I, 328; 1939, I, 509). Unusually high Eu_2O_3 contents (~0·2%) are recorded for specimens from Forbes Reef (Swaziland), Salzburg, and Brazil. A. J. E. W.

Petrography of chromite–dolomite refractories. D. S. BELJANKIN and B. V. IVANOV (Bull. Acad. Sci. U.R.S.S., Cl. Sci. Tech., 1939, No. 9, 53—60).—Petrographic examination of these refractories has shown the complexity of the silicate component, which contains Cr in various stages of oxidation and Ca_2SiO_4. The solid solution of periclase contains Fe and Mn, but no Cr. R. C.

Zircon studies in the New Jersey Highlands. S. A. TYLER (Amer. J. Sci., 1940, **238**, 260—271).—The zircons occurring in the Franklin limestone, the gneisses, the pegmatite, and the Fe ores are described; they are mainly of the hyacinth variety. A younger granite in southeastern New York contains the malacon type. The variety of the zircon can be used to distinguish rocks of widely-separated age in this area. The relation of zircon to the origin of these rocks is discussed. L. S. T.

Fluorite in the ore-bearing regions of the Kara-Tau range. V. GALITZKI (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 385—388).—Hydrothermal CaF_2 is widespread in the carbonate rocks of the Kara-Tau range, the content ranging from 0·06 to 0·9%. J. W. S.

Problem of the carbonate-apatites. III. Carbonate-apatite from Magnet Cove, Arkansas. D. MCCONNELL and J. W. GRUNER (Amer. Min., 1940, **25**, 157—167; cf. A., 1939, I, 47).—Carbonate-apatite associated with fluorapatite (I) from this locality is described. It occurs as a replacement of (I), and is probably hydrothermal in origin. The different optical properties of carbonate-apatites cannot be accounted for in terms of contamination of (I) by $CaCO_3$. The conclusion that carbonate-apatites are to be explained by such contamination is not supported by other evidence. The mineral substance of teeth and bones should be regarded as a carbonate-hydroxyapatite or dahllite. L. S. T.

Paleozoic phosphorites of Armenia. G. I. BUSCHINSKI (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 237—239).—P_2O_5 contents of the rocks and phosphorites of the Sary-baba mountains and the western end of the Zindzhirlu range are recorded and discussed. L. S. T.

Weathering of jarosites. F. V. TSCHUCHROV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 256—257).—At the commencement of weathering jarosites usually acquire a reddish colour which is attributed to a high [Fe_2O_3] in those solutions which impregnate the jarosites and cause instability and hydrolytic splitting as a result of which hydrogoethites, morphologically similar, are formed. W. R. A.

Factors of composition and porosity in lead-zinc replacements of metamorphosed limestone. J. S. BROWN (Amer. Inst. Min. Met. Eng., Tech. Publ., 1940, No. 1194, 14 pp.; Min. Tech., 1940, **4**, No. 2).—Pure limestone is generally resistant to ore replacement, but the reason is not necessarily connected with porosity; intensely silicated rock is also unfavourable to replacement. The best condition for this to occur is for the rock to consist of an intimate (1 : 1) mixture of silicates and $CaCO_3$, but no correlation has been detected between the tendency to replacement and the porosity of the rock. A. R. P.

Vaucluse gold mine, Orange Co., Virginia. C. E. BASS (Econ. Geol., 1940, **35**, 79—91).—History, production, and mining methods are described. The host rock is a quartz-sericite-chlorite schist. Pyrite is the only abundant sulphide, and contains most of the Au, which is the only valuable mineral recovered, and is of high purity. L. S. T.

Coal metamorphism in the Anthracite-Crested Butte Quadrangles, Colorado. E. C. DAPPLES (Econ. Geol., 1940, **35**, 109).—A correction (cf. A., 1939, I, 588). L. S. T.

Correlation of the Satpukuria seam in the Raniganj coalfield. M. M. MUKHERJI (Trans. Min. Geol. Met. Inst. India, 1939, **35**, 313—328).—Evidence that this seam is identical with the Ghusick seam is put forward. L. S. T.

Absorbing complex of soil. Paragenetic system of (colloidal) minerals. I. D. SEDLETZKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 258—262).—From previous data, it is concluded that a natural paragenetic association of minerals, distributed regularly over genetic horizons, corresponds with every soil, the minerals of the absorbing soil complex being composed of minerals formed under conditions of modern soil-formation. The properties of the absorbing complex vary with the character of mineral association. W. R. A.

Lime-secreting algæ and algal limestones from the Pennsylvanian of Central Colorado. J. H. JOHNSON (Bull. Geol. Soc. Amer., 1940, **51**, 571—595).—Algæ of CaO-secreting habit were present in considerable nos. during the Pennsylvanian, and contributed much calcareous material to the deposits. Chemical analyses of eight types are recorded. L. S. T.

Significance of limestones in the process of formation of ore bodies of the scarn type. K. A. VLASSOV (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 222—225).—The part played by $CaCO_3$ in the development of ore bodies in various deposits of the U.S.S.R. is discussed. L. S. T.

***X*-Ray study of aragonite in natural and cultured pearls.** A. E. ALEXANDER (Amer. J. Sci., 1940, **238**, 366—371).—*X*-Ray diffraction patterns of six representative pearls are reproduced, and correlated with microscopical examination. The powder diagrams of a natural crystal of aragonite from Biln, Bohemia, and a natural Oriental salt-water pearl are identical; little, if any, amorphous material is present. L. S. T.

Silver, lead, and zinc deposits of Manchuria. T. OGURA (Mem. Ryojun Coll. Eng., 1939, **12**, 205—242).—Ten mines are in operation and yield ~4000 tons of Pb, Ag, and Zn sulphide concentrates per month. The richer ore deposits occur mainly in limestone, granite, or gneiss. Primary ore minerals are galena (0·10—0·29% Ag) and sphalerite. Small amounts of chalcopyrite, argentite, molybdenite, arsenopyrite, and a few other sulphides occur. $ZnCO_3$ is absent. Oxidation in the Pb and Zn ores is not unusual. The Ag, Pb, and Zn deposits of Manchuria are classified into (i) fissure fillings (90%), (ii) contact, and (iii) metasomatic deposits. Origin and paragenesis are discussed. L. S. T.