BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

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

JUNE, 1941.

I.—SUB-ATOMICS.

Proposed standard solar-radiation curves for engineering use. P. Moon (*J. Franklin Inst.*, 1940, **230**, 583—617).—Data obtained by various workers on solar radiation are correlated, and a standard spectral distribution curve for sunlight outside the atm. is given. Methods are described which enable results to be corr. for elevation and air mass.
A. J. M.

Determination of $1/\lambda_2 - 1/\lambda_1$ for the D_1, D_2 lines of sodium. G. F. C. Searle (*Proc. Physical Soc.*, 1941, **53**, 265—271).—The method depends on adjusting a plate and lens for the coincidence of the Newton rings due to D_1-light with either the rings due to D_2-light or the dark spaces between those rings. The val. found for $1/\lambda_2 - 1/\lambda_1$ is 17·434 cm.$^{-1}$ compared with 17·19 deduced from the standard vals. of λ_1 and λ_2.
N. M. B.

Term values in V II and Mn II. D. S. Bowman (*Physical Rev.*, 1941, [ii], **59**, 386—388).—Calc. term vals. for d^3s and d^5s in Russell–Saunders coupling are tabulated. Theoretical formulæ including Ostrofsky's results for d^4 (cf. A., 1934, 1285) are then applied to the observed vals. for V II and Mn II.
N. M. B.

Reflecting-power measurements in the spectral region 2000—1300 A. B. K. Johnson (*Proc. Physical Soc.*, 1941, **53**, 258—264).—Reflexions % of Al, Cr, Si, speculum, Ag, Pt, glass, fused quartz, and LiF have been measured at 7 different $\lambda\lambda$ by means of a special apparatus, and are tabulated.
N. M. B.

***L*-Emission bands of sodium, magnesium, and aluminium.** W. M. Cady and D. G. Tomboulian (*Physical Rev.*, 1941, [ii], **59**, 381—385).—A spectrophotometric study of the radiation band emitted when conduction electrons fill vacancies in the *L* shell is reported. The band shape represents the energy distribution of the conduction electrons, and observed shapes are in general agreement with theory and confirm available experimental data (cf. O'Bryan, A., 1934, 577). In each case a "tail" is observed at the low-frequency end of the band, and explanations are proposed. With the *X*-ray continuum as a standard of intensity, the total intensity of the *L* band increases 19-fold from Na to Al.
N. M. B.

Breakdown potentials of gases under alternating voltages. G. W. Fox and D. O. McCoy (*J. Appl. Physics*, 1940, **11**, 592—595).—The breakdown potentials of N_2, H_2, He, and A of commercial purity have been investigated with varying pressures and gap distances (10—50 mm.) and for frequencies up to 10^6 cycles per sec. A discharge tube with spherical electrodes was used. Curves of log pressure against log gap distance are drawn for each gas and each frequency. The slope of this curve is independent of frequency, and also of the gas used if the gap distance is small.
A. J. M.

Extraction of electrons from cold metals at high field-strengths. W. Jackson and A. E. Chester (*J. Inst. Electr. Eng.*, 1941, **88**, Part I, 149—160).—The experimental technique of the investigation of field emission from cold metals is described. It is concluded that the Fowler–Nordheim theory is substantially correct in giving, for pure metals, the dependence of field emission on field strength and on temp. It also explains adequately the energy distribution of the electrons involved. The modification of the Fowler–Nordheim theory to take into account the effect of surface films is shown to be in agreement with experiment. Breakdown phenomena and total-voltage effects are discussed. Beams' work on the Hg cathode is considered. The field emission of thin films, such as oxide films, is also discussed. A bibliography is given.
A. J. M.

Scattering of fast electrons by heavy elements. II. J. H. Bartlett, jun., and T. A. Welton (*Physical Rev.*, 1941, [ii], **59**, 281—290; cf. A., 1939, I, 594).—Mathematical. The modification of scattering, due to extranuclear electrons, when fast electrons impinge on a Hg atom is calc. Scattering as a function of angle is determined for 100- and 230-kv. electrons. Phase shifts are determined by three different methods. Results are compared and discussed.
N. M. B.

Secondary electron emission from metals. A. E. Kadischevitsch (*J. Physics U.S.S.R.*, 1940, **2**, 115—129).—Mathematical. The mechanism of secondary electron emission from metals is discussed, and it is shown that its intensity (I) depends on the ratio (r) of the path of a primary electron before its velocity becomes low to the free path of the secondary electron. With increasing energy of the incident electrons, *i.e.*, with increasing r, I increases until $r = 0·56$, after which it decreases. The course of the calc. I–r curve is in accord with observation. The variation of I with the angle of incidence of the primary electrons, and the velocity and directional distribution of the secondary electrons, are also deduced.
J. W. S.

Distribution function for electrons in a metal in a strong magnetic field. V. A. Dmitriev (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 601—603).—Mathematical. W. R. A.

Contraction of plasma in a magnetic field. E. M. Reichrudel and G. V. Spivak (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 609—613).—The contraction of plasma produced by a magnetic field has been measured in A and Hg vapour using (*a*) a flat anode which was capable of vertical and horizontal movement, and (*b*) an anode of the concentric-ring type. In both methods the anode c.d. served as a measure of the relative electron concn. at a given point in the plasma and the experimental data from both methods agree.
W. R. A.

Ionisation maximum for protons. N. Feather (*Nature*, 1941, **147**, 510—511).—A crit. discussion of the conclusions of Holloway and Moore (A., 1941, I, 142). Evidence that the max. sp. ionisation is $\nless$ one half, rather than one third, of the max. sp. ionisation due to an α-particle is quoted.
L. S. T.

Probability of formation of pairs in gases by γ-rays. L. V. Groschev (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 448—450).—The effective cross-section (s) of Xe for electron-pair production by γ-rays from Th-C'', derived from Wilson chamber measurements, is $5·8 \times 10^{-25}$ sq. cm. This val. is compared with data for Kr and N_2 (cf. A., 1940, I, 306). In each case s is $<$ the val. calc. from Born's approximation; Jaeger and Hulme's formula (A., 1936, 400) gives an approx. const. ratio ($= 2$) of calc. to observed s vals., showing that this formula gives the correct dependence of s on Z.
A. J. E. W.

Angular distribution for electron–positron pairs in gases. L. V. Groschev (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 451—453; cf. A., 1940, I, 307).—The distribution of the following angles has been studied from a statistically adequate no. of Wilson chamber measurements of pair production by Th-C'' γ-rays in N_2, Kr, and Xe: angles between the tracks of photon and positron (χ), photon and electron (ψ), and positron and electron (ϕ); the angle (α) between the photon track and the plane of the pair; the dihedral angle (Φ) between planes passing through the photon and the positron and electron tracks, respectively. The mean vals. of χ, ψ, and ϕ increase approx. linearly with Z; contrary to Born's approximation, the mean χ and ψ vals. are equal only in N_2. The Φ distributions are similar, large vals. being favoured. Small α vals. are strongly preferred. The results are in qual. agreement with Jaeger and Hulme's calculations (A., 1938, I, 591). A. J. E. W.

Relative abundance of oxygen isotopes. B. F. Murphey (*Physical Rev.*, 1941, [ii], **59**, 320; cf. Smythe, A., 1934, 469).—With a 60° mass spectrometer, the ratio found for a large no. of determinations on air and commercial O_2 is $^{16}O/^{18}O = 500 \pm 15$, and, from a complete mass spectrum of the 33 peak corr. for background, $^{18}O/^{17}O = 4{\cdot}9 \pm 0{\cdot}2$. Hence the physical–chemical mass scale conversion factor is $1{\cdot}000275 \pm 0{\cdot}000009$. N. M. B.

Energy of neutrons from the deuteron–deuterium reaction. T. W. Bonner (*Physical Rev.*, 1941, [ii], **59**, 237—240; cf. A., 1939, I, 397).—A precision determination gives the val. $3{\cdot}58 \pm 0{\cdot}03$ Me.v. for the energy of the neutrons emitted in the forward direction to the 0·52-Me.v. deuterons which produce the disintegrations. $Q = 3{\cdot}31 \pm 0{\cdot}03$ Me.v. and hence the calc. mass of ^3He is $3{\cdot}01698 \pm 0{\cdot}00006$ mass units. N. M. B.

Slow neutron velocity spectrometer. C. P. Baker and R. F. Bacher (*Physical Rev.*, 1941, [ii], **59**, 332—348).—Neutron bursts were produced by modulation of the arc source of a small cyclotron. Neutrons slowed in paraffin were detected by a BF_3 ionisation chamber and linear amplifier with discriminating amplifier and modulator circuit. Thin Cd showed a resolved resonance absorption with max. at 0·14 e.v. For thick Cd the absorption edge was not sharp, the transmission being 0·5 at 0·47 e.v. Thick Rh and In absorbers showed resonance absorption at 1·0 e.v. A study of delayed emission of thermal neutrons from the paraffin surrounding the source showed an effective mean life of 170 μ-sec. From the thin Cd absorption curve the total width Γ of the resonance level was 0·12 e.v., and from the cross-section at resonance $[1 \pm (1/2i + 1)]\Gamma_n$, where Γ_n is the neutron width and i is the angular momentum of the absorbing nucleus, the val. was 5×10^{-4} e.v. N. M. B.

Capture cross-section for thermal neutrons of Cd, ^{6}Li, ^{10}B, Ba, Hg, and ^{1}H. E. L. Harrington and J. L. Stewart (*Canad. J. Res.*, 1941, **19**, **A**, 33—41).—A comparison method for the determination of capture cross-sections for thermal neutrons by working with aq. solutions is described. Assuming the val. 2600×10^{-24} sq. cm. for Cd, the following vals. have been obtained: ^{10}B, 2760×10^{-24}; ^6Li, 846×10^{-24}; Hg, 323×10^{-24}; Ba, $<21{\cdot}4 \times 10^{-24}$, and ^1H, $0{\cdot}464 \times 10^{-24}$ sq. cm. The vals. for Ba and H differ widely from those found by other workers. F. J. G.

Nomenclature of nuclear particles. C. Møller (*Physical Rev.*, 1941, [ii], **59**, 323; cf. A., 1941, I, 70).—The term nucleon, instead of nuclon, is proposed for heavy nuclear constituents, neutrons and protons. N. M. B.

β-Ray spectra of light elements. A. A. Townsend (*Proc. Roy. Soc.*, 1941, **A**, **177**, 357—366).—A magnetic spectrometer, which is described, was used to investigate the β-ray spectra of some artificial radioactive elements. All the spectra follow the Fermi distribution law for a certain range near the high-energy end-point. The half-life periods (in parentheses) and end-points in Me.v. are: for ^{11}C (20·6 min.) $0{\cdot}981 \pm 0{\cdot}005$, for ^{13}N (9·95 min.) $1{\cdot}218 \pm 0{\cdot}004$, for ^{56}Mn (2·55 hr.) $2{\cdot}88 \pm 0{\cdot}01$ and $1{\cdot}035 \pm 0{\cdot}015$, for ^{64}Cu (10·6 hr.) positrons $0{\cdot}649 \pm 0{\cdot}004$ and negatrons $0{\cdot}574 \pm 0{\cdot}004$, for ^{63}Zn (39 min.) $2{\cdot}320 \pm 0{\cdot}005$. G. D. P.

Disintegration of boron by slow neutrons. R. S. Wilson (*Proc. Roy. Soc.*, 1941, **A**, **177**, 382—392).—The disintegration was studied by means of an ionisation chamber filled with BCl_3. Two disintegration energies were observed. The greater of these is assumed to correspond with the formation of the ^7Li nucleus in the ground state; the smaller, which is released in about 93% of the disintegrations, is due to the formation of ^7Li in an excited state of approx. 0·4 Me.v. The γ-radiation associated with the return of the excited ^7Li to the ground state was detected and its quantum energy roughly measured. G. D. P.

Application of a pressure electrostatic generator to the transmutation of light elements by protons. T. Lauritsen, C. C. Lauritsen, and W. A. Fowler (*Physical Rev.*, 1941, [ii], **59**, 241—252).—The design and performance of a large generator capable of operating at 1·7 M.v. under 80 lb. per sq. in. are discussed. Studies of γ-radiation produced in the transformation of ^{19}F, ^{15}N, and ^{13}C by protons are reported. N. M. B.

Transmutation of fluorine by protons. J. F. Streib, W. A. Fowler, and C. C. Lauritsen (*Physical Rev.*, 1941, [ii], **59**, 253—270).—The excitation functions for the production of long-range α-particles, γ-rays, and electron pairs by the bombardment of ^{19}F by protons up to 1·5 Me.v. energy are observed simultaneously. The long-range α and pair curves show resonance peaks superimposed on a background of increasing intensity with increasing bombarding energy. There is evidence that full- and short-range α-particles preceding pair emission can be products of competing modes of decay of the same intermediate states of ^{20}Ne. This suggests that the state of ^{16}O which decays by pair emission has the same parity (even) as the ground states of ^{16}O and thus that the pair emission can be due to ordinary electromagnetic forces. Abs. yields of the various processes are measured, and the measurement of high-energy γ-ray and pair yields by electroscopes is discussed. N. M. B.

Long-lived radioactive carbon, ^{14}C. S. Ruben and M. D. Kamen (*Physical Rev.*, 1941, [ii], **59**, 349—354).—^{14}C was produced by deuteron bombardment of graphite and by slow-neutron irradiation of N compounds (NH_4NO_3, NH_4NO_2, etc.). The radiations consist of low-energy negative electrons of range 19 ± 2 mg. per sq. cm. of Al (145 ± 15 ke.v. upper energy limit). No soft or hard γ-rays were detected. The reactions must be $^{13}C\,(d, p)\,^{14}C$ and $^{14}N\,(n, p)\,^{14}C$. No decay over 9 months was shown. Cross-section and yield estimates indicate a half-life of 10^3—10^5 years. The production, isolation, and detection of ^{14}C for tracer work is described. N. M. B.

Protons from the deuteron bombardment of the separated isotopes of chlorine. E. F. Shrader and E. Pollard (*Physical Rev.*, 1941, [ii], **59**, 277—280; cf. A., 1940, I, 339).—By bombarding with 3·2-Me.v. deuterons targets in which the proportion of ^{37}Cl had been increased by >100%, Q vals. of groups of protons were assigned as follows: $^{35}Cl\,(d, p)\,^{36}Cl$ 6·31, 5·35, and 1·50 Me.v., $^{37}Cl\,(d, p)\,^{38}Cl$ 4·02, 3·02, and 2·10 Me.v., leading to isotopic masses ^{36}Cl 35·9808 and ^{38}Cl 37·9806. A group of α-particles at 12 cm. range is assigned to ^{35}Cl according to the reaction $^{35}Cl\,(d, \alpha)\,^{33}S$; the Q val. is 9·1 Me.v., giving $^{33}S = 32{\cdot}9828$ in good agreement with 32·9826 from the $^{32}S\,(d, p)\,^{33}S$ reaction. N. M. B.

Mechanism of chemical reactions accompanying the isomeric radioactive transition of ^{80}Br. J. E. Willard (*J. Amer. Chem. Soc.*, 1940, **62**, 3161—3165).—In the gas phase the isomeric radioactive transition $^{80}Br^*$ (4·4 hr.) $\rightarrow$ $^{80}Br^*$ (18 min.) results in <2% reaction of ^{80}Br (18 min.) with CCl_4, whereas in the liquid and solid phases 30% and 12% reaction occurred, respectively. In the condensed phases free radicals are thought to be formed by different mechanisms and they react with $^{80}Br^*$ (18 min.). The production of $^{80}Br^*$ (18 min.) from $^{80}Br^*$ (4·4 hr.) in chemical reactions may take place in three ways: (*a*) decomp. reactions, *e.g.*, $Et^{80}Br$ (4·4 hr.) $\rightarrow$ $Et^{80}Br$ (18 min.)$^+$ + ε, $Et^{80}Br$ (18 min.)$^+$ $\rightarrow$ Et + ^{80}Br (18 min.)$^+$; (*b*) addition reaction in which ^{80}Br (18 min.)$^+$ ions acquire an electron and then combine with a free radical, *e.g.*, CCl_4 + ^{80}Br (18 min.)$^+$ + $\varepsilon \rightarrow CCl_3$ + ^{80}Br (18 min.) + Cl, followed by CCl_3 + ^{80}Br (18 min.) $\rightarrow$ $CCl_3{}^{80}Br$ (18 min.); (*c*) similar to (*b*) but involving combination with a normal mol. and not with a radical, *e.g.*, ^{80}Br (18 min.) + $C_2H_2 \rightarrow$ $C_2H_2{}^{80}Br$ (18 min.), followed by $C_2H_2{}^{80}Br$ (18 min.) + HBr $\rightarrow$ $C_2H_3{}^{80}Br$ (18 min.) + Br. At least 90% of the isomeric ^{80}Br transitions are accompanied by emission of a conversion electron rather than by γ-radiation. W. R. A.

Deuteron bombardment of gold. R. S. Krishnan (*Proc. Camb. Phil. Soc.*, 1941, **37**, 186—193).—The bombardment of Au with 9·1-Me.v. deuterons gives rise to the formation of 2·7-day ^{198}Au by a (d–p) process, and of 32-hr. ^{193}Hg in a metastable state by a (d–n) process. The energies of the β- and γ-rays emitted by these nuclei have been obtained. The excitation functions for the two reactions have been determined and are discussed. No evidence is obtained for the occurrence of any reaction involving the simultaneous ejection of two particles, and the formation of a 19-hr. Ir isotope (Cork *et al.*, A., 1938, I, 548) could not be detected. A. J. M.

Radioactive isotopes of germanium. G. T. Seaborg, J. J. Livingood, and G. Friedlander (*Physical Rev.*, 1941, [ii], **59**, 320—321; cf. Sagane, A., 1939, I, 172).—Bombardment of Ga with 8-Me.v. deuterons produced a 40 ± 2-hr. positron emitter and an 11-day activity due to ^{69}Ge or ^{71}Ge from the

d, 2*n* reaction from ^{69}Ga and ^{71}Ga. Ge bombarded with 16-Me.v. deuterons gave the same periods assigned to the reaction ^{70}Ge (*d*, *p*) ^{71}Ge. Ge (40 hr.) emits 1·2-Me.v. positrons, and Ge (11 days) emits particles of ∼0·6 Me.v. energy, and no γ-rays. Bombardment of Ge with 16-Me.v. deuterons gave a 90-min. activity, and As bombarded with fast neutrons gave a Ge fraction (89±2 min.) attributed to ^{75}As (*n*, *p*) ^{75}Ge. Fast-neutron bombardment of Ge and Se gave a 90-min. period attributed to ^{76}Ge (*n*, 2*n*) ^{75}Ge and ^{78}Ge (*n*, α) ^{75}Ge. ^{75}Ge (89 min.) gave β-particles of max. energy 1·2±0·1 Me.v. The product ^{77}Ge (12 hr.) is confirmed to arise from the *d*, *p* reaction in the bombardment of Ge with 16-Me.v. deuterons, and by the *n*, α reaction in the fast-neutron bombardment of Se. ^{69}Ge (29 min.), reported by Sagane, was not found.
N. M. B.

Radioactive isotope of protoactinium. G. T. Seaborg, J. W. Gofman, and J. W. Kennedy (*Physical Rev.*, 1941, [ii], **59**, 321).—Experiments described confirm that the 25-day activity due to slow-neutron bombardment of Th is $^{233}_{91}$Pa and not a Zr isotope. U chemically separated from the decay of $^{233}_{91}$Pa was inactive with respect to β-particle emission.
N. M. B.

Radioactive $^{41}_{21}$Sc, $^{35}_{18}$A, and $^{31}_{16}$S. D. R. Elliott and L. D. P. King (*Physical Rev.*, 1941, [ii], **59**, 403; cf. A., 1941, I, 143).—Half-lives (sec.) and max. energy of emitted positrons (Me.v.), respectively, are: Sc 0·87±0·03, 4·94±0·07; A 1·88±0·04, 4·41±0·09; S 3·18±0·04, 3·87±0·15, in good agreement with the results of White *et al.* (cf. *ibid.*, 94) except in the case of the A half life. N. M. B.

Radioactive isotopes of osmium. G. T. Seaborg and G. Friedlander (*Physical Rev.*, 1941, [ii], **59**, 400).—Os bombarded with slow neutrons from a cyclotron gives activities of periods 32±2 hr. and 17±1 days; the upper energy limits of the β-particles are 1·5 and 0·35 Me.v., respectively. Bombardment of Os with fast neutrons gives a weaker production of both activities, but the ratio of 32-hr. to 17-day activity is twice as large with the fast as with the slow neutrons. The provisional assignments are ^{191}Os (32 hr.) and ^{193}Os (17 days). N. M. B.

Radiation properties of heavy nuclei. V. F. Weisskopf (*Physical Rev.*, 1941, [ii], **59**, 318—319; cf. A., 1940, I, 187).—Mathematical. A provisional method of estimating the order of magnitude of radiative transition probabilities between nuclear levels of heavy nuclei is deduced. Results agree with available data. N. M. B.

Radiative transition probabilities in heavy nuclei. Excitation of nuclei by *X*-rays. E. Guth (*Physical Rev.*, 1941, [ii], **59**, 325—331).—Mathematical. From experimental absorption cross-sections for excitation of nuclei (^{115}In and Pb) by *X*-rays (cf. Waldman, A., 1940, I, 190), radiation widths, *i.e.*, emission probabilities, are deduced; they are of the same order as those of the low levels of the natural radioactive nuclei. Formulæ for the transition probabilities, depending on both energy and spin, are given. A simple expression, valid near the short-λ limit, for the intensity of *X*-rays produced by fast electrons is given. Doppler effect and self-absorption are considered. N. M. B.

Velocity–range relation for fission fragments. N. Bohr (*Physical Rev.*, 1941, [ii], **59**, 270—275).—A development of previous considerations (cf. A., 1941, I, 3). In estimating the effect of electronic interactions a comparison with the stopping of α-particles of the same velocities is used. In contrast to α-rays, fission-fragment tracks show, in agreement with calc. data, considerable range straggling at the end part of the range. N. M. B.

Range and straggling of fission fragments. J. K. Bøggild, K. J. Brostrøm, and T. Lauritsen (*Physical Rev.*, 1941, [ii], **59**, 275—277; cf. A., 1941, I, 144).—Evidence of two groups of fission-fragment tracks corresponding with two types of fragments is supported by bombarding thin evaporated U layers on mica foils with slow neutrons in a cloud chamber. Histograms of ranges and sums of ranges of paired fragment tracks, relative to ranges of α-particles of similar velocities, show mean ranges of 19 and 25 mm. in A and 23 and 30 mm. in He for the two groups. The relatively lower stopping power of He is probably due to a smaller rate of velocity loss towards the end of the range for fragments than for α-particles, with relatively greater straggling (cf. preceding abstract).
N. M. B.

Fission products of uranium by fast neutrons. Y. Nishina, T. Yasaki, K. Kimura, and M. Ikawa (*Physical Rev.*, 1941, [ii], **59**, 323—324; cf. A., 1941, I, 3).—From purified U_3O_8, bombarded for ∼12 hr. by fast neutrons, Rh (34 hr.) and Ru (∼4 and ∼60 hr.) were separated. Rh (34 hr.) is an electron emitter giving β-rays of max. energy 0·5 Me.v., and the decay product is probably a stable Pd isotope. N. M. B.

β-Ray spectrum of $^{233}_{91}$ekatantalum. E. Haggstrom (*Physical Rev.*, 1941, [ii], **59**, 322; cf. following abstract).—A preliminary description of the complex spectrum which consists mainly of conversion lines. The end-point is ∼230 ke.v.
N. M. B.

Fourth (4*n* + 1) radioactive series. A. V. Grosse, E. T. Booth, and J. R. Dunning (*Physical Rev.*, 1941, [ii], **59**, 322—323).—Experiments show that $^{233}_{90}$Th is not identical with ^{239}U. Th captures neutrons by a strong resonance process above the Cd cut-off at <25 e.v. energy. A search for $^{233}_{91}$A (2—3 min.) by irradiating Th with neutrons was unsuccessful, but slow neutrons gave a β-emitting product $^{233}_{91}$Et (27·4±0·4 days) (cf. preceding abstract). Decay curves are shown, and quant. separation from Zr proves that it is not a Zr isotope. N. M. B.

Report of cosmic ray observations made on the U.S. Antarctic Expedition in co-operation with the Bartol Research Foundation. S. A. Korff and E. T. Clarke (*J. Franklin Inst.*, 1940, **230**, 567—581).—The investigation of the latitude effect for cosmic rays, carried out on the above expedition, is reported. Geiger counter observations indicate that there is a definite "knee" in the cosmic-ray intensity curve at about geomagnetic latitude 39° S. Between this latitude and the equator a drop of 8% occurs, and between 39° and 77° S. a variation of 3±0·3% is found. Comparable results were obtained with a Millikan electroscope. The application of an external temp. coeff. of −0·15% per 1° c. makes the curve horizontal south of 39°. 154 bursts were recorded during 43 days of operation, and were classified according to size. The results suggest a latitude effect for the bursts of the same order as that for the total intensity. The sp. ionisation does not vary with latitude, so that the ratio of electrons to mesotrons is const. at all latitudes south of 39°.
A. J. M.

Multiplicative showers. M. Schönberg (*Ann. Acad. Brasil. Sci.*, 1940, **12**, 281—299).—A discussion of the deviation from the observed data of the theories of Bhabha and Heitler and of Carlson and Oppenheimer. F. R. G.

Variation of the rate of decay of mesotrons with momentum. B. Rossi and D. B. Hall (*Physical Rev.*, 1941, [ii], **59**, 223—228; cf. A., 1940, I, 190).—Investigations of mesotrons of range 196—311 and also >311 g. per sq. cm. of Pb show that the softer group disintegrate ∼3 times as fast as the more penetrating group, in agreement with theory based on relativity. From measurements on particles of momentum ∼5 × 10^{8} e.v./*c* the new val. of the proper lifetime of mesotrons is (2·4±0·3) × 10^{-6} sec. N. M. B.

Scattering of mesotrons in tungsten. F. L. Code (*Physical Rev.*, 1941, [ii], **59**, 229—232).—With a 30-cm. counter-controlled cloud chamber in a 12,900-oersted magnetic field, measurements of scattering angle θ and curvature for 359 tracks gave $\bar{E}\theta = 0$—13·7 × 10^{9} e.v. degrees for $\theta = 0$—18·7° and mean energies $\bar{E} < 2 \times 10^{9}$ e.v. There were also 92 high-energy tracks with a deflexion too small to be measured. Results confirm Williams' prediction of a Gaussian distribution of multiple scattering (cf. A., 1939, I, 291), and observed anomalous large-angle scattering supports theory as regards nuclear forces. The calc. mean multiple electrical scattering is 2·2 × 10^{9} e.v. degrees compared with the experimental val. 2·14 × 10^{9}. This agreement supports the assumption that the main force responsible for the Gaussian part of the scattering is that arising from the electric charges of the mesotron and nucleus. N. M. B.

Correlation between cosmic-ray intensity at Cheltenham [U.S.A.] and the air temperatures and pressures for 1939. N. F. Beardsley (*Physical Rev.*, 1941, [ii], **59**, 233—237; cf. A., 1940, I, 188).—Data show that the variation of cosmic-ray intensity depends 15% on total air pressure, 40% on the distribution of the air mass as correlated with the surface temp., 10% on world-wide changes, and 30% unaccounted for. N. M. B.

Change in height of a mesotron-producing layer of air. N. F. Beardsley (*Physical Rev.*, 1941, [ii], **59**, 402).—Mathematical. An application of Blackett's theory (cf. A., 1939, I, 55) to experimental data (cf. preceding abstract). Results indicate that Blackett's assumption of a decaying mesotron formed at a height which changes from day to day is a possible explanation for some observed variations in cosmic-ray intensity at the surface. N. M. B.

Cosmic rays at a depth equivalent to 1400 metres of water. Y. Nishina, Y. Sekido, Y. Miyazaki, and T. Masuda (*Physical Rev.*, 1941, [ii], **59**, 401; cf. Barnóthy, A., 1939, I, 351).—Coincidence counter measurements indicate the existence of a high proportion of hard showers and the absence of non-ionising primary rays, although evidence as to whether the primaries for the hard showers are ionising or non-ionising particles is inconclusive. N. M. B.

Intensities of radiofrequency spectra. H. C. Torrey (*Physical Rev.*, 1941, [ii], **59**, 293—299).—Mathematical. Theoretical and observed line shapes are compared by taking account of the inhomogeneity in velocity of the beam mols. N. M. B.

Self-consistent field calculations for (A) Zn, Ga, Ga^+, Ga^{+++}, As, As^+, As^{++}, As^{+++}, (B) Ge^{++} and Ge. W. Hartree, D. R. Hartree, and M. F. Manning (*Physical Rev.*, 1941, [ii], **59**, 299—305, 306—307).—Full data with tables of wave functions and effective nuclear charges are reported. N. M. B.

Phase series. E. J. Hellund (*Physical Rev.*, 1941, [ii], **59**, 395—399).—Mathematical. An expansion theorem for the calculation of the parameters occurring in the scattering cross-sections is developed. The series converges exponentially and is expressible in terms of known functions, provided the interactions are expressed as a power series in r and $1/r$. N. M. B.

Coulomb exchange energy in light nuclei. M. Phillips and E. Feenberg (*Physical Rev.*, 1941, [ii], **59**, 400).—Isobaric mass differences reported by Haxby *et al.* (cf. A., 1941, I, 68) and Fowler *et al.* (cf. A., 1936, 659) find a simple qual. explanation in the periodic variation of the Coulomb exchange energy as calc. in the Hartree approximation (cf. A., 1937, I, 109, 278). N. M. B.

Exchange effects in the theory of the continuous absorption of light. I. Ca and Ca^+. D. R. Bates and H. S. W. Massey (*Proc. Roy. Soc.*, 1941, **A**, **177**, 329—340).—A theoretical investigation including the effect of electron exchange which appreciably modifies the results, particularly in the case of Ca^+ and of K. A discrepancy between Strömgren's and Struve's independent determinations of the interstellar electron density is removed. G. D. P.

Polarisation of electrons by double scattering. H. S. W. Massey and C. B. O. Mohr (*Proc. Roy. Soc.*, 1941, **A**, **177**, 341—357).—The scattering of electrons by Au, Xe, and Kr has been investigated using Dirac's equations. The polarisation to be expected by double scattering at 90° has been studied in the energy range 100—150,000 e.v. At energies for which the intensity of single scattering at 90° is near a min. a large polarisation is to be expected for Au. For Xe and Kr the polarisation is never $>4\%$ and 2% respectively. Modifications of the interaction between nucleus and electron which would reduce polarisation are considered. The polarisation resulting from double scattering by a potential well is investigated in detail. G. D. P.

Relation between ionic radii, atomic and quantum numbers, and valency. S. T. Li and C. E. Sun (*J. Chinese Chem. Soc.*, 1940, **7**, 73—75).—Ionic radii of common elements are calc. from the expression $0{\cdot}42Z^{-1}z^{-1/3}n^3$, in which Z is the at. no., z the valency, and n the principal quantum no. For Li to F inclusive n^3 is replaced by n^2. The calc. vals. are tabulated with those of other authors. F. L. U.

II.—MOLECULAR STRUCTURE.

Electronic transitions of the BH molecule. A. E. Douglas (*Canad. J. Res.*, 1941, **19**, **A**, 27—31).—A discharge in He containing traces of BCl_3 and H_2 shows bands at 3415, 3396, and 3099 A., due to two previously unobserved electronic transitions of the BH mol. from new $^1\Sigma^+$ upper states C and D to the known $^1\Pi$ state B. The rotational consts. are evaluated and an electron configuration of the BH mol. is suggested. With the two new $^1\Sigma^+$ states there are now six known electronic states of BH and these are completely analogous to the six known states of AlH. J. W. S.

(0, 3) Band of the first negative system of O_2^+. T. E. Nevin and T. Murphy (*Proc. Roy. Irish Acad.*, 1941, **A**, **46**, 169—181; cf. A., 1940, I, 183).—The λ 7348 ($0 \rightarrow 3$) band of this system, which is due to the transition $^4\Sigma_g^- \rightarrow {}^2\Pi_u$, was developed in a hollow-cathode discharge and photographed in dispersion 1·25 A. per mm. Rotational analysis data are tabulated, and consts. of the final level $v'' = 3$ are calc. N. M. B.

Excitation of light emission from quartz under impact with canal rays of hydrogen and nitrogen. V. T. Chiplonkar (*Current Sci.*, 1941, **10**, 19—21).—Canal rays of H and N of energies between 4 and 12 kv. excite light emission from quartz. With both exciting sources three groups of lines at 2870, 2150, and 2210 A., belonging to either Si or O or both, are observed. The intensity distribution of the H continuum shows max. at 4000 and 3200 A. and a shallow min. at $\sim$3600 A. but when fluorescence from the quartz window is eliminated only the max. at 4000 A. is observable and that very faintly. Quartz does not emit a continuum. W. R. A.

Vibrational frequencies of polyatomic molecules. M. Eliaschevitsch (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 604—608).—Mathematical. A general method of obtaining the equations of motion in vector form for calculation of vibrational frequencies. W. R. A.

Ultra-violet absorption spectra of organic molecules. Dependence on restricted rotation and resonance. M. T. O'Shaughnessy and W. H. Rodebush (*J. Amer. Chem. Soc.*, 1940, **62**, 2906—2911).—The ultra-violet absorption spectra of 21 mols. containing aromatic rings have been examined and can be interpreted in terms of Mulliken's theories. The absorption spectra can serve as a criterion for restricted rotation in Ph_2 derivatives and similar mols. in which coplanarity is necessary for resonance. W. R. A.

Absorption spectrum of squalene. Z. Nakamiya and K. Koizumi (*Bull. Inst. Phys. Chem. Res. Japan*, 1941, **20**, 141—149).—Squalene (I) has no special absorption max. Absorption bands of crude samples were removed by purification using acid clay as adsorbent. The low-boiling fraction from vac. distillation of (I) shows bands with max. at 273, 283, and 296 mμ. High-boiling fractions show absorption max. at 265, 276, 287, and 296 mμ. Low-boiling fractions from vac. distillation of pristane show three absorption bands distinct from those of either fraction from (I). O. D. S.

Effect of ions of the lyotropic series on reflexion in the 3 μ. region. A. M. Buswell, R. C. Gore, and W. H. Rodebush (*J. Physical Chem.*, 1941, **45**, 543—546).—Dissolved Na salts increase the reflectivity of H_2O in the 3 μ. region and shift the peak of reflexion to higher frequencies. This may mean that the ions tend to destroy the 4-co-ordinated structure of liquid H_2O, making it possible for H_2O mols. to reflect and absorb energy at a frequency more nearly similar to that of the fundamental O–H vibrations in the vapour state. The effect of the salt anion decreases in the order $I' > CNS' > Br' > Cl' > SO_4'' > NO_3' > H_2O$. C. R. H.

Absorption of fluorescent light by fluorescent liquids. W. S. Hill (*Ann. Acad. Brasil. Sci.*, 1940, **12**, 261—268).—Fluorescent solutions may be identified by the absorption coeff. determined in a colorimeter. F. R. G.

Conjugation of carbonyl groups and the absorption spectrum of triketopentane. M. Calvin and C. L. Wood (*J. Amer. Chem. Soc.*, 1940, **62**, 3152—3155).—The absorption spectrum of triketopentane (I) in *iso*octane at −50° is compared with the spectra of $COMe_2$ and Ac_2 in C_6H_{14} at room temp. The introduction of the third adjacent C:O group produces very slight further shift to longer $\lambda\lambda$ and the vibrational structure, exhibited by Ac_2, is absent. (I) has a non-coplanar structure. W. R. A.

Isomeric structure of C_{18} unsaturated [fatty] acids from their Raman and infra-red spectra.—See A., 1941, II, 159.

Raman spectrum of aqueous potassium cyanate. F. F. Cleveland (*J. Amer. Chem. Soc.*, 1941, **63**, 622—623).—Raman displacements and intensities and depolarisation factors of Raman lines are given for fresh and aged aq. KOCN. The fresh solution exhibits three lines with displacements 1225, 1315, and 2171 cm.$^{-1}$, whilst after 3 days these disappear and three lines are found with displacements 1003, 1033, and 1064 cm.$^{-1}$ Aq. $(NH_4)_2CO_3$ and NH_4HCO_3 give displacements of 1020 and 1007 cm.$^{-1}$ and suggest that the displacements exhibited by the aged solution arise from the hydrolysis products. W. R. A.

Raman spectra of acetylenes. III. Five monosubstituted and four disubstituted acetylenes. F. F. Cleveland and M. J. Murray (*J. Amer. Chem. Soc.*, 1940, **62**, 3185—3188; cf. A., 1939, I, 9; 1940, I, 96).—Raman *vv*, intensities, and depolarisation factors are recorded for 9 substituted acetylenes and tentative assignments of observed *vv* have been made. W. R. A.

Absorption and re-emission of light by *cis*- and *trans*-stilbenes and the efficiency of their photochemical isomerisation. G. N. Lewis, T. T. Magel, and D. Lipkin (*J. Amer. Chem. Soc.*, 1940, **62**, 2973—2980).—Fluorescence and absorption spectra of *cis*- and *trans*-stilbene have been measured. Interconversion of the isomerides by 2537 A. has been determined. Results are interpreted in terms of the "loose-bolt" theory of Lewis and Calvin (*Chem. Rev.*, 1939, 25, 273) and the theories of Olson (A., 1931, 578) on the electronically excited states of the isomerides. W. R. A.

Fluorescence of purines and pyrimidines. (Miss) M. M. Stimson and (Miss) M. A. Reuter (*J. Amer. Chem. Soc.*, 1941, **63**, 697—699).—The fluorescence of 20 purines and pyrimidines, derivatives of uracil and adenine, has been studied in the solid state and in NaOH, aq. NH_3, and H_2SO_4; generally, the fluorescence in basic solutions is $>$ that in acid solution. The application of these data in the ultrachromatographic purification of the compounds is discussed. W. R. A.

Ionisation and dissociation of diatomic molecules by electron impact. H. D. Hagstrum and J. T. Tate (*Physical Rev.*, 1941, [ii], **59**, 354—370).—The shapes of the peaks in the graph of resolved ion current as a function of ion-accelerating potential are analysed and accounted for in terms of the wave-mechanical theory of the diat. mol. and the characteristics of the mass spectrometer. Information thus obtained could previously be obtained in part from retarding potential methods and in part from the mass spectrometer. Peak shape and appearance-potential measurements lead to conclusions on the nature of the dissociation process and structure of the mol. Data for H_2, CO, NO, N_2, and O_2 are reported and existing discrepancies are cleared up. N. M. B.

New spectral effect in a barrier-layer photo-effect of carborundum single crystals and a new method for determination of the long wave-length limit. O. V. Losev (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 360—362).—An active layer ~ 1 μ. thick, subjected to an accelerating e.m.f. and illuminated with monochromatic light, shows a single component of the photo-effect which approaches a saturation val. with increasing e.m.f. The saturation val. increases relatively to the zero-e.m.f. effect with decreasing λ between 280 and 436 mμ. The saturation current–λ relation found leads to a val. 645—652 mμ. for the long-λ limit of the photo-effect. L. J. J.

Spectral distribution of the barrier-layer photo-effect with carborundum single crystals. O. V. Losev (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 363—364).—With layers ~ 1 μ. thick, the photoelectric current produced by monochromatic illumination, in the absence of accelerating e.m.f., is a max. at $\lambda \sim 350$ mμ., and decreases to very small vals. with increasing λ in the region 450—650 mμ. The max. shifts towards shorter $\lambda\lambda$ with decreasing thickness of active layer. L. J. J.

Dipole moments of some complex compounds of aluminium chloride. I. A. Scheka (*Ber. Inst. Chem. Akad. Wiss. Ukrain.*, 1940, **7**, 57—69).—The dipole moments have been calc. from the dielectric const. of dil. solutions in C_6H_6. The moment of $AlCl_3$,*o*-$C_6H_4Cl\cdot NO_2$ is 9·48, of $AlCl_3$,*p*-$C_6H_4Cl\cdot NO_2$ 7·79, $AlCl_3$,*p*-PhOMe 6·54, $AlCl_3$,*o*-$C_6H_4Me\cdot NO_2$ 8·92, and $AlCl_3$,*p*-$C_6H_4Me\cdot NO_2$ 9·68 × 10^{-18} e.u. The difference between these moments and those of the free org. mol. is const. and equals 5·3. This indicates an identical deformation of $AlCl_3$ in all these compounds. J. J. B.

Dipole moments of lead alkyl and phenyl halides. G. L. Lewis, P. F. Oesper, and C. P. Smyth (*J. Amer. Chem. Soc.*, 1940, **62**, 3243—3246).—The following vals. of dipole moment in C_6H_6 at 25° are recorded: $PbPh_3$ 0, $PbMe_3Cl$ 4·47, $PbEt_3Cl$ 4·39, $PbEt_2Cl_2$ 4·70, $PbEt_3Br$ 4·46, $PbPh_3Cl$ 4·21, $PbPh_3Br$ 4·21, $PbPh_3I$ 3·73 D. $PbPh_3$ gives a zero moment because of its dimerisation to Pb_2Ph_6. Vals. of Pb–halogen bond moments and of the amounts of ionic character in the bonds have been computed. W. R. A.

Bond moment additivity and the electric moments of some halogenated hydrocarbons. A. A. Maryott, M. E. Hobbs, and P. M. Gross (*J. Amer. Chem. Soc.*, 1941, **63**, 659—663).—Vals. of dipole moments, μ, in the gas state are given for CH_2Cl_2 1·58, $CHCl_3$ 1·02, $CMeCl_3$ 1·79, $CHMeCl_2$ 2·07, CMe_2Cl_2 2·25, *cis*-$C_2H_2Cl_2$ 1·89, and CH_2Br_2 1·43 D. The influence on μ of substitution on a central atom is related to the availability of the electrons of the central atom to the substituent group. The low val. for *cis*-$C_2H_2Cl_2$ is due to resonance in which C–Cl bonds acquire some double-bond character and ionic nature with Cl positive. W. R. A.

Molecular refraction of ions of *l*-aspartic acid. V. A. Pertzoff (*J. Amer. Chem. Soc.*, 1940, **62**, 3150—3151).—Assuming that Na *l*-aspartate gives the anion

$\overset{-}{\mathrm{C}}\mathrm{OO}\cdot\mathrm{CH}(\overset{+}{\mathrm{N}}\mathrm{H_3})\cdot\mathrm{CH_2}\cdot\overset{-}{\mathrm{C}}\mathrm{OO}$ in H_2O, and the anion

$\overset{-}{\mathrm{C}}\mathrm{OO}\cdot\mathrm{CH}(\mathrm{NH_2})\cdot\mathrm{CH_2}\cdot\overset{-}{\mathrm{C}}\mathrm{OO}$ in 0·5M-NaOH, vals. of R_L have been calc. from at. and ionic refractions which are in good agreement with experimental vals. W. R. A.

Electrophiles and electrodotes. N. F. Hall (*J. Amer. Chem. Soc.*, 1941, **63**, 883).—Mols. which share their electron pairs with acids (in Lewis sense) or yield electrons to oxidants have been termed electrodomic by Luder (*Chem. Rev.*, 1940, 27, 579). The term "electrodotic" or "electrodotal" is preferred. W. R. A.

Relation between acidic and basic properties of hydroxides, atomic and quantum numbers, and valency. C. E. Sun and S. T. Li (*J. Chinese Chem. Soc.*, 1940, **7**, 69—72; cf. A., 1937, I, 412).—The val. of the expression Zz/n^3, where Z is the at. no., z the valency, and n the principal quantum no., is computed for the elements and for several multivalent ions. If the val. is $<1·44$ the resulting hydroxide is a base, and if $>1·44$, an acid; the greater is the departure from 1·44, the stronger is the base or acid. When the val. $= \sim 1·44$ the hydroxide is amphoteric. F. L. U.

Non-adiabatic reactions. Rotation about the double bond. J. L. Magee, W. Shand, jun., and H. Eyring (*J. Amer. Chem. Soc.*, 1941, **63**, 677—688).—A model of the potential for rotation about the ethylenic double bond is given. Two possible types of isomerisation reactions are discussed; one is an adiabatic reaction having essentially the "normal" properties for first-order reactions, the other is a non-adiabatic reaction of small frequency due to (i) the smallness of the interaction between the two potential surfaces and (ii) only a few of the states in the final potential being available to mols. in the initial potential. The isomerisation of Me_2 maleate and Δ^{β}-butene takes place by the non-adiabatic mechanism and calc. and experimental rates are in good agreement. Tunnelling is considered to be negligible in the process. W. R. A.

Theory of volume magnetostriction. R. Smoluchowski (*Physical Rev.*, 1941, [ii], **59**, 309—317).—Mathematical. A treatment on the basis of mol. field theory. Instead of assuming a saturation magnetisation I independent of vol. at abs. zero, the dependence of I on temp. for coupled and uncoupled electrons is assumed to be given by a Brillouin function. Hence are obtained, with the help of experimental data on the magnetostriction of Fe, the val. for the mol. field "const." N, its dependence on the relative change of vol., and the dependence on vol. of I at $T = 0$. Satisfactory agreement with results obtained from other considerations is found. N. M. B.

Energy associated with capillary rise. R. C. Brown (*Proc. Physical Soc.*, 1941, **53**, 233—234).—Mathematical. The energy required to raise the column against gravity is shown to equal that required to overcome the viscous forces. By equating their sum to the energy made available by the wetting of the walls of the tube, the usual capillary-rise equation is obtained. N. M. B.

Densities, surface tensions, and parachors of diborane, boron triethyl, and boron tribromide. Atomic parachor of boron. A. W. Laubengayer, R. P. Ferguson, and A. E. Newkirk (*J. Amer. Chem. Soc.*, 1941, **63**, 559—561).—ρ, γ, and parachor for B_2H_6, BEt_3, and BBr_3 have been determined and the at. parachor of B has been deduced and is found to vary with change in bond type. W. R. A.

III.—CRYSTAL STRUCTURE.

Correction of *X*-ray diffraction intensities for Lorentz and polarisation factors. M. J. Buerger (*Proc. Nat. Acad. Sci.*, 1940, **26**, 637—642).—The magnitude of the Lorentz correction for *X*-ray diffraction by a rotating crystal is calc. by consideration of the reciprocal lattice. The correction can be applied in the author's recording method (A., 1939, I, 537) by means of a single rotating cam. The polarisation correction can be applied by surrounding the crystal with an envelope of slightly absorbing material of suitably varied thickness. L. J. J.

Measurement of particle size by the *X*-ray method. A. Taylor (*Phil. Mag.*, 1941, [vii], **31**, 339—347).—Expressions for the diffraction broadening, β, of *X*-ray diffraction max. by small crystallites are discussed. A method of obtaining β which avoids lengthy graphical integration is suggested. It is shown that the sudden onset of growth in a small fraction of the crystallites in a specimen leads to anomalous results for the particle size if a small Debye–Scherrer camera is used. The use of a camera of 19 cm. diameter is essential in this case. The order of error involved if a small camera is used, and a fraction of the total sample is bigger than 1000 A., the remainder being almost unchanged, is calc. A. J. M.

Analysis of liquid *X*-ray diffraction patterns. N. S. Gingrich (*Physical Rev.*, 1941, [ii], **59**, 290—292).—The corr. intensity curve for the diffraction of *X*-rays by liquid A (cf. A., 1940, I, 404) is subjected to four different fittings to determine the sensitivity of the at. distribution curve to errors in fitting. An analysis of each fitting is made. N. M. B.

Diffuse *X*-ray reflexions. (Mrs.) K. Lonsdale (*Nature*, 1941, **147**, 481—482; cf. A., 1941, I, 153).—The physical interpretation of Faxén's formula, that the surfaces of const. intensity surrounding the Bragg points are spheres, is true only when $i - i_B$ is small. Different assumptions, *e.g.*, existence of small groups, waves of the Raman type, or elastic heat waves, give the same formula for small vals. of $i - i_B$ because, in the derivation of each formula, it is assumed that the spreading of the intensity of reflecting power around each reciprocal lattice point is independent of direction; the formulæ are a geometrical way of expressing the fact that near the reciprocal lattice points the distribution may be taken as spherical. Experiments show that, in general, the surfaces of isodiffusion, particularly when $i - i_B$ is not small, are not spherical. L. S. T.

Diffuse reflexion of *X*-rays. H. A. Jahn (*Nature*, 1941, **147**, 511).—The Preston–Bragg block hypothesis (A., 1941, I, 153) is not reconcilable with the Faxén–Waller theory. The general Faxén–Waller expression has been evaluated for various relative vals. of the three elastic consts. of a cubic crystal, and the marked dependence of the scattering power on the elastic anisotropy demonstrated. The theoretical curves of isodiffusion of Na single crystals are reproduced. L. S. T.

Diffuse scattering of *X*-rays by potassium chloride crystals. S. Siegel (*Physical Rev.*, 1941, [ii], **59**, 371—375).—An extension of work previously reported (cf. A., 1940, I, 285). Using Cu $K\alpha$ radiation, observations in the immediate region of a strong reflexion were made, and shapes and half-widths of the max. were studied as functions of the direction of incidence. Results agree with theory (cf. Zachariasen, *ibid.*). N. M. B.

Apparent sizes of atoms in metallic crystals with special reference to aluminium and indium, and the electronic state of magnesium. W. Hume-Rothery and G. V. Raynor (*Proc. Roy. Soc.*, 1940, **A**, **177**, 27—37).—The interat. distances in crystals cannot be accounted for by assigning a fixed at. radius to each atom. The causes of this variation are considered in terms of the Brillouin zones of the structures. The apparent sizes of Al and In atoms in the alloys which they form with Cu, Ag, and Au are discussed and shown to be in agreement with theory. New experimental data for the lattice spacings of the solid solutions of Al and In in Mg are given; the *a* parameter varies smoothly and continuously with concn. but the *c* parameter shows an abrupt change at 0·75% In or Al. G. D. P.

Nature of the chemical bond in graphite and boron nitride. A. Brager and H. Shdanov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 629—631).—Using a one-dimensional Fourier series and recorded data for graphite and BN it is shown that the distributions of the electron density perpendicular to (00*l*) in both are similar and that there are between the layers one free electron per C and two free electrons per B–N pair. The layers of BN consist of B^-N^+ ions, each ion having an electronic configuration similar to C. This would explain similarities in structure and certain physical properties. W. R. A.

Determination of crystal densities by the temperature-of-flotation method. Density and lattice constant of lithium fluoride. C. A. Hutchison and H. L. Johnston (*J. Amer. Chem. Soc.*, 1940, **62**, 3165—3168).—A method for determining ρ to 0·00001 is described which combines "temp. flotation" of small crystals with calibration of the flotation liquid by hydrostatic weighings. ρ^{25} for LiF is $2{\cdot}63905 \pm 0{\cdot}0001$, and hence the lattice const. is $a^{25} = 4{\cdot}01736 \pm 0{\cdot}00004$ A. in close agreement with the val. ($4{\cdot}01732 \pm 0{\cdot}00004$ A.) from *X*-ray data of Straumanis (A., 1939, I, 184). The utilisation of ρ and *X*-ray measurements on LiF in providing a standard of wave-length measurements, or in determining accurately the val. of *N*, or in comparing the at. wt. of F and Cl, is indicated. W. R. A.

Interatomic distances in cobalt diselenide. B. Lewis and N. Elliott (*J. Amer. Chem. Soc.*, 1940, **62**, 3180—3181).—From *X*-ray powder photographs of $CoSe_2$ the interat. distances are Co—Se = $2{\cdot}43 \pm 0{\cdot}01$ and Se—Se = $2{\cdot}49 \pm 0{\cdot}04$ A. The metallic properties of $CoSe_2$ are attributed to the presence of "metallic" electrons not used by Co in the formation of covalent linkages. W. R. A.

Crystal chemical studies of the alums. II. Purple chrome alums. H. P. Klug. **III. Solid solution studies.** H. P. Klug and L. Alexander (*J. Amer. Chem. Soc.*, 1940, **62**, 2992—2993, 2993—2995; cf. A., 1940, I, 349).—II. Lattice consts. at 25° for $MCr(SO_4)_2,12H_2O$ (M = NH_4, K, Rb, Cs, Tl, NH_3Me) and ρ^{25} have been determined. The NH_4 and K compounds have the α-structure, whilst the others have the β-structure. These structures are compared with corresponding Al alums and it is shown that Rb and Tl compounds have different structures in the two types of alum and that lattice consts. for Cr alums are > those for Al alums by approx. 0·038 A.

III. Solid solutions of the pairs of alums, $TlAl(SO_4)_2,12H_2O$–$NH_4Al(SO_4)_2,12H_2O$ (**I**), $TlAl(SO_4)_2,12H_2O$–$KAl(SO_4)_2,12H_2O$ (**II**), and $NH_4Cr(SO_4)_2,12H_2O$–$KCr(SO_4)_2,12H_2O$ (**III**) have been investigated by means of *X*-rays. (**I**) follows Vegard's law but (**II**) and (**III**) show slight deviations in which the size of substituting ions plays an important rôle. The size of ions does not, however, appear to be important from the viewpoint of the distribution ratios between liquid and solid solutions. The co-ordination of Cr in the Cr alums does not change for final mixed alums regardless of the direction of approach to equilibrium. Lattice consts. at 25° for NH_4 and Tl Al alums are 12·215 and $12{\cdot}206 \pm 0{\cdot}001$ A., respectively. W. R. A.

Structures of complex fluorides. Barium fluosilicate and fluogermanate. J. L. Hoard and W. B. Vincent (*J. Amer. Chem. Soc.*, 1940, **62**, 3126—3129).—The *X*-ray spectra of $BaSiF_6$ and $BaGeF_6$ have been investigated. The mols. are isomorphous and have a CsCl-like structure of $Ba^{\cdot\cdot}$ and $Si(Ge)F_6''$ (approx. regular octahedral) with a rhombohedral angle of ~98°, 1 mol. per unit cell, *a* 4·75 and 4·83 A., α 97° 58′ and 98° 1′, respectively, space-group D_{3d}^5—$R3m$. Each $Ba^{\cdot\cdot}$ ion is approx. equidistant from 12 F atoms to give a BaF_{12} co-ordination group, a type of structure predicted for compounds of formula RMX_2 in which $R/X \geq 1$. W. R. A.

Structure of melamine, $C_3N_6H_6$. I. E. Knaggs and K. Lonsdale. **Optical properties of melamine.** R. G. Wood and G. Williams (*Proc. Roy. Soc.*, 1940, **A**, **177**, 140—147).—*X*-Ray examination shows that the structure is monoclinic, space-group $P2_1/a$, with 4 mols. in the unit cell. The magnetic anisotropy has been measured and an approx. structure is suggested. New optical data confirm that the structure is of the layer type, and resembles that of all other cyanuric ring compounds that have been examined. G. D. P.

Crystal structure of selenium diphenyl dibromide. J. D. McCullough and (Miss) G. Hamburger (*J. Amer. Chem. Soc.*, 1941, **63**, 803—807).—*X*-Ray investigation of the orthorhombic crystals of $SePh_2Br_2$ indicates that they contain 4 mols. per unit cell, a_0 13·95, b_0 5·78, c_0 15·40 A., space-group D_{2h}^{14}—*Pbcn*. The $SePh_2Br_2$ mol. has an approx. trigonal bipyramidal structure with Se at the centre, Br at the apices, and three equatorial positions occupied by the two Ph and the unshared pair. The mol. symmetry is C_2—2. Observed bond angles and bond distances are: Br–Se–Br 180°$\pm$3°; C–Se–C 110°$\pm$10°; Se—Br 2·52$\pm$0·01; Se—C 1·91$\pm$0·03 A. W. R. A.

Crystal structure of tetraphenylarsonium iodide, $(C_6H_5)_4AsI$. (Miss) R. C. L. Mooney (*J. Amer. Chem. Soc.*, 1940, **62**, 2955—2959).—*X*-Ray diffraction data show that $AsPh_4I$ forms tetragonal crystals, space-group S_4^2—$I\bar{4}$, 2 mols. per unit cell, *a* 12·194, *c* 7·085 A. Essentially the structure consists of two interpenetrating body-centred lattices, one of $AsPh_4^{\cdot}$ ions and the other of I′ ions. $AsPh_4^{\cdot}$ ions are tetrahedra with Ph—As distance of 1·95 A. Each $AsPh_4^{\cdot}$ is surrounded at 4·13 A. by 8 I′ ions. The I co-ordination sphere consists of 16 C. W. R. A.

***X*-Ray and crystallographic study of ribonuclease.**—See A., 1941, III, 387.

Resistance of metals at very low temperatures. S. V. Vonsovski (*J. Physics U.S.S.R.*, 1940, **2**, 113—114).—On the basis of Bloch's one-electron model of a metal it is shown that at very low temp. the time of the free path of an electron may exceed the period of the accelerating action of a direct electrical field on an electron in the crystal lattice, with the result that the resistance of the metal tends to infinity, in accord with observations on Au (A., 1938, I, 302). The same inference also follows from Schubon's metal atom model (A., 1936, 134). J. W. S.

Influence of a magnetic field on the electrical conductivity of bismuth single crystals at low temperatures. B. Davidov and I. Pomerantschuk (*J. Physics U.S.S.R.*, 1940, **2**, 147—160).—Mathematical. On the assumption that the conductive electrons and positive holes in Bi are few and approx. equal in no., the influence of the quantisation of electrons on the increase of residual resistance in a transverse magnetic field is discussed, and wave equations for "tightly bound" Bloch electrons are derived. It is shown that the no. of collisions responsible for the residual resistance depends only on the energy of the electrons, and the current strength is derived. The theoretical degeneracy temp. is 70° K. (observed 140° K.) and the no. of free electrons (n) is $\sim 0{\cdot}6 \times 10^{-5}$ per atom. At higher temp. $n \propto T^{1{\cdot}5}$, this accounting for the increase in the Hall coeff. with decrease of temp. J. W. S.

Hysteresis in ferromagnetics. E. Kondorski (*J. Physics U.S.S.R.*, 1940, **2**, 161—181).—The theory developed previously (A., 1940, I, 200) is extended, and approx. formulæ are derived for the variation of the residual magnetism, coercive force, and hysteresis losses with field intensity in an isotropic ferromagnetic comprising infinitely long parallel cylindrical grains, each of which has an axis of easy magnetisation in a field parallel to the geometrical axis. The results are in accord with measurements on cold-drawn Ni and Fe–Ni alloy wires. J. W. S.

Magnetisation near saturation in polycrystalline ferromagnets. T. Holstein and H. Primakoff (*Physical Rev.*, 1941, [ii], **59**, 388—394).—Mathematical. The effect of the rotation of the magnetisation vector, under the combined influence of the magnetic field and cryst. anisotropy, on the variation of the magnetisation of ferromagnets near saturation is studied; the Akulov–Gans treatment is amended by taking into account the internal magnetic field arising from the magnetisation itself. Results are applied to the analysis of experimental data. N. M. B.

Optical crystallographic studies with the polarising microscope. III. Measurement of several types of selective dispersion in organic compounds. W. M. D. Bryant (*J. Amer. Chem. Soc.*, 1941, **63**, 511—516).—Dispersion measurements have been made on $NH_2\cdot CO_2Bu^a$, 2 : 2′-dipyridyl, *o*-nitroacetanilide, guanylcarbamide picrate, and β-hydroxyethylamine picrate. Other optical characteristics are given and discussed. W. R. A.

Crystal form of sucrose octa-acetate. C. D. West (*J. Amer. Chem. Soc.*, 1941, **63**, 630).—Sucrose octa-acetate (I) separates from $COMe_2$ on keeping for several weeks at room temp. as prisms, m.p. 84·5°, ρ 1·335. It crystallises in one of the enantiomorphous symmetry classes of orthorhombic bisphenoidal symmetry. The elements for a single crystal have been calc. W. R. A.

Stability of crystal lattices. VI. Properties of matter under high pressure and the lattice theory of crystals. R. Fürth (*Proc. Camb. Phil. Soc.*, 1941, **37**, 177—185).—The results of Bridgman (cf. A., 1940, I, 155) on the compression of solids under very high pressure are compared with those obtained theoretically by applying Born's thermodynamic treatment of the properties of crystals. The substances most favourable for comparison are In, S, and Sb. The calc. and observed isotherms (curves of V/V_0 against p/p_0 for different vals. of T/θ, where V_0 is the vol. at abs. zero and vanishing pressure, and p_0 and θ are characteristic consts. of the material, related by the equation $p_0V_0 = R\theta$) are compared. The theory does not give an exact mathematical description of the experimental results, but provides a rough picture of thermodynamic behaviour. Bridgman's work on the vol. decrement on cooling a substance from room temp. to solid CO_2 temp. at atm. pressure compared with the corresponding decrement at 50,000 atm. also agrees as well as can be expected with Born's theory. The stability of a lattice under uniform negative pressure is also considered. A. J. M.

Behaviour of Young's modulus of β-brass single crystals at low temperature. J. S. Rinehart (*Physical Rev.*, 1941, [ii], **59**, 308—309; cf. A., 1940, I, 407).—Measurements on 7 single crystals at liquid O_2 and dry ice–$COMe_2$ temp. show that the reciprocals of the moduli *E* in different directions in the crystal lattice vary linearly with temp. down to −183°, and the anomalous variations of *E* with direction, observed at room temp., persisted. N. M. B.

Origin and spacing of slip bands. E. Orowan (*Nature*, 1941, **147**, 452—453).—The fact that the spacing of slip bands on plastically deformed crystals fluctuates about a mean val., which is usually between 0·5 and 10 μ., is discussed. A formula for the min. spacing of slip bands is given. The spacing of slip planes is the spacing of the parallel lattice planes enlarged in the proportion of the mol. shear strength to the actual shear stress. L. S. T.

Thermo-allotropic modifications of sulphur. C. Q. Sheely (*J. Chem. Educ.*, 1941, **18**, 30).—These modifications are represented diagrammatically. L. S. T.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES.

Magnetic susceptibilities of complex cyanides with transition element cations. J. Richardson and N. Elliott (*J. Amer. Chem. Soc.*, 1940, **62**, 3182—3183).—The magnetic susceptibilities of $K_2MnFe(CN)_6$, $K_2CoFe(CN)_6$, $K_2CuFe(CN)_6$, $KCoCo(CN)_6$, $K_2CoCo(CN)_6,2H_2O$, and $KNiCo(CN)_6$ have been determined by the Gouy method. The magnetic moments agree with vals. calc. on the assumption that each substance contains a ferro- or cobalti-cyanide ion in which the transition element is forming d^2sp^3 bonds to the CN group and other heavy metals are present as simple ions. W. R. A.

Measurement of adiabatic differential magnetic susceptibility near 1° K. Heat capacity of gadolinium phosphomolybdate tridecahydrate from 0·17° to 4·7° absolute. W. F. Giauque, J. W. Stout, C. J. Egan, and C. W. Clark (*J. Amer. Chem. Soc.*, 1941, **63**, 405—410).—Vals. of C_p for $GdPMo_{12}O_{40},30H_2O$ have been determined from 0·187° to 4·192° K. by cooling the sample by adiabatic demagnetisation and supplying energy by an amorphous C thermometer–heater. The vals. agree with calorimetric measurements. The adiabatic differential magnetic susceptibility, $(\partial I/\partial H)$, has been measured by an apparatus which is described. W. R. A.

Velocity of sound in, and chemical reactivity of, bromine and iodine. B. N. Sen (*Current Sci.*, 1941, **10**, 22—23; cf. A., 1939, I, 67).—The formula for calculating the velocity of sound in metals can be applied satisfactorily to Br and I, the val. of the numerical const. for metallic elements (2·54) being multiplied by 10. W. R. A.

Heat capacity and entropy of silver iodide and their interpretation in terms of structure. K. S. Pitzer (*J. Amer. Chem. Soc.*, 1941, **63**, 516—518).—Vals. of C_p for AgI have been determined calorimetrically from 15·09° to 301·37° K. and the derived val. of $S^0_{298\cdot1}$ is 27·6 g.-cal. per degree per mol. These and existing data are used in discussing the structure of AgI above and below the transition point 146° K. The increased intensity of coloration of AgI on heating is related to decreasing average co-ordination no. and increasing deviation from pure ionic bond character. W. R. A.

Heat capacity and entropy, heats of fusion and vaporisation, and vapour pressure of *n*-pentane. G. H. Messerly and R. M. Kennedy (*J. Amer. Chem. Soc.*, 1940, **62**, 2988—2991).—C_p vals. have been measured calorimetrically from 12° to 288° K. The following vals. for n-C_5H_{12} are given: m.p. 143·47° K. (—129·69°); heat of fusion at 298° K. 2011·2±1; heat of vaporisation at 298° K. 6262±15 g.-cal. per mol.; v.p. from 208° to 298° K. $\log_{10} p_{(\text{mm.})} = -2312\cdot80/T - 10\cdot18859 \log T + 0\cdot0050000T + 8\cdot75 \times 10^{-7}(260\cdot0 - T)^2 + 34\cdot18793$; mol. entropy of liquid at 298·18° K. 62·78±0·2 and of gas at 1 atm. and 298·18° K. 83·13±0·2 g.-cal. per degree per mol. The torsion of Et against Pr groups in n-C_5H_{12} is restrained by a potential of ∼16,000 g.-cal., which is equiv. to a torsional frequency of ∼185 cm.$^{-1}$ as deduced from the difference between the entropy vals. calc. from thermal and spectroscopic data. W. R. A.

Thermal data. XIV. Heat capacities and entropies of some compounds having the peptide bond. H. M. Huffman (*J. Amer. Chem. Soc.*, 1941, **63**, 688—689).—Heat capacities from 85° to 298° K. have been measured for *dl*-alanylglycine, glycylglycine, *dl*-leucylglycine, hippuric acid, and hippurylglycine and vals. of $S_{298\cdot1}$ are respectively 51·0, 45·4, 67·2, 57·2, and 75·2 g.-cal. per degree per mol. W. R. A.

Heat capacities of organic compounds containing nitrogen and the atomic heat of nitrogen. S. Satoh and T. Sogabe (*Sci. Papers Inst. Phys. Chem. Res. Tokyo*, 1941, **20**, 197—203; cf. A., 1941, I, 78).—The mean sp. heats for the range 0—99·6° of *o*-, *m*-, and *p*-nitro-benzoic (**I**) and -cinnamic acids (**II**), and NHPhAc and p-NO_2·C_6H_4·NHAc have been measured. Vals. of the at. heat of N in the NO_2-group are calc. For both (**I**) and (**II**) the calc. at. heat of N decreases in the order *o*- > *m*- > *p*-. The mean val. of the at. heat is 4·22. O. D. S.

Relation between atomic radii and b.p. C. E. Sun, C. L. Tseng, and S. T. Li (*J. Chinese Chem. Soc.*, 1940, **7**, 65—68).—The empirical relation previously used (cf. A., 1937, I, 505, in which for V^3 read V^2) is applied to the calculation of b.p. of acid chlorides and anhydrides and simple and mixed ketones. There is good agreement between calc. and observed vals. F. L. U.

B.p. of benzene, ββγ-trimethylbutane, γ-ethylpentane, and ββδδ-tetramethylpentane within the pressure range 100—1500 mm. E. R. Smith (*J. Res. Nat. Bur. Stand.*, 1941, **26**, 129—134).—The b.p. of these compounds have been determined at various pressures by Swientoslawski's method, using H_2O as reference material. Equations are derived expressing the relationship between v.p. and temp.; the b.p. at 760 mm. are 80·098°, 80·872°, 93·468°, and 122·283°, respectively. J. W. S.

Transition between liquid and vapour. E. Winning (*Tekn. Tidskr.*, 1940, **70**, 225—226).—It is suggested that a vapour contains only mols. moving in straight lines, whereas a liquid consists mainly of mols. moving in closed paths, with a small no. of "vapour-like" mols. moving in straight lines; these last are responsible for the Brownian movement. Addition of heat to a liquid increases preferentially the speed of the "vapour-like" mols. (assumed to be moving faster than the "liquid-like" mols. in any case), equilibrium being restored by collision of a "vapour-like" with a "liquid-like" mol., giving the latter a straight-line path and thus resulting in vapour formation and absorption of latent heat. Superheated liquids contain less than the equilibrium amount of "vapour-like" mols. The expression: $H_{\text{liquid}} = c_w t + \rho_{\text{vapour}}\cdot l(\rho_{\text{liquid}} - \rho_{\text{vapour}})$, where $c_w = c$ for the "liquid-like" mols. in the liquid, is derived. It gives close agreement with published vals. of H for H_2O between 10° and 374°, c_w being taken as 0·9951. M. H. M. A.

Line co-ordinate chart for vapour pressures of organic solvents. D. S. Davis (*Ind. Eng. Chem.*, 1941, **33**, 401).—A nomograph presenting v.p.–T data for eight org. solvents has been constructed from experimental data of Gardner (cf. B., 1940, 332). C. R. H.

Vapour pressures of organic compounds. I. J. M. Stuckey and J. H. Saylor (*J. Amer. Chem. Soc.*, 1940, **62**, 2922—2925).—V.p. from 4° to 75° of C_6H_6, *o*- and m-C_6H_4MeCl and -C_6H_4MeBr, methyl*cyclo*hexane, and COMe·C_5H_{11} are represented by an equation $\log P = -A/(T - C) + B$, whilst the v.p. of *o*-, *m*-, and *p*-xylene, mesitylene, PhEt, and p-C_6H_4MeCl fit an equation $\log P = -A/T - 5 \log T + B$. Vals. of the consts. are given for each compound. W. R. A.

Pressure–volume–temperature relations of *n*-hexane and β-methylpentane. E. A. Kelso and W. A. Felsing (*J. Amer. Chem. Soc.*, 1940, **62**, 3132—3134).—Compressibilities of liquid n-C_6H_{14} and β-methylpentane at 25° intervals from 100° to 225° and P–V–T relations for the gaseous states at 250° and 275° and at different mol. vol. have been determined. W. R. A.

Alkyls of the third-group elements. I. Vapour-phase studies of the alkyls of aluminium, gallium, and indium. A. W. Laubengayer and W. F. Gilliam. **II. Electron diffraction study of indium trimethyl.** L. Pauling and A. W. Laubengayer (*J. Amer. Chem. Soc.*, 1941, **63**, 477—479; 480—481).—I. From v.p. and vapour density measurements $GaEt_3$ and $InMe_3$ are monomeric in the vapour state, $AlMe_3$ is dimeric at 70° and ∼34% monomeric at 156°, and $AlEt_3$ is ∼12% dimeric at 150°. V.p. data and thermal consts. are recorded.

II. The distance In—C in $InMe_3$ is 2·16±0·04 A., which is 0·05 A. < the sum of the tetrahedral radii of In and C and corresponds with a trigonal radius of 1·39 A. for In. Although most probably the angle In–C–In is 120° and not 109° 28′, this cannot be unequivocally decided. W. R. A.

Calculating Beattie–Bridgeman constants from critical data. S. H. Maron and D. Turnbull (*Ind. Eng. Chem.*, 1941, **33**, 408—410).—The five consts., independent of T and P, contained in Beattie and Bridgeman's equation of state can be evaluated for any gas from its crit. consts. and from the Beattie–Bridgeman and crit. consts. of a reference gas, N_2. The consts. for twelve gases have been evaluated and with their aid compressibility vals. have been obtained. These latter agree with observed data over a wide range of T and P, and are generally superior to vals. calc. from van der Waals' equation at all temp. except in the interval T_r = 1·00—1·25. C. R. H.

Thermal expansion of aluminium from 0° to 650°. A. J. C. Wilson (*Proc. Physical Soc.*, 1941, **53**, 235—244).—Precision measurements of the lattice spacing of Al as a function of temp. by means of a high-temp. Debye–Scherrer *X*-ray camera, and calc. coeffs. of expansion, are reported. Results are discussed in relation to Grüneisen's law. N. M. B.

Thermal conductivity of liquids. Twelve industrial chlorinated hydrocarbons. O. K. Bates, G. Hazzard, and G. Palmer (*Ind. Eng. Chem.*, 1941, **33**, 375—376).—Thermal conductivity data at 20°, 30°, 40°, and 50° for CH_2Cl_2, $CHCl_3$, CCl_4, *syn*- and *trans*-$CHCl{:}CHCl$, $CHCl{:}CCl_2$, $CCl_2{:}CCl_2$, $(CH_2Cl)_2$, $CH_2Cl\cdot CHCl_2$, $(CHCl_2)_2$, $CHCl_2\cdot CCl_3$, and $CHMeCl\cdot CH_2Cl$ are tabulated. C. R. H.

Thermal conductivity and viscosity of steam at high temperatures and pressures. D. L. Timroth and N. B. Vargaftik (*J. Physics U.S.S.R.*, 1940, **2**, 101—111; cf. A., 1938, I, 566).—The thermal conductivity of steam has been measured at 100—550° and 1—300 atm. by the hot-wire method, with quartz tubes 0·5 mm. wide to avoid error due to convection. The coeff. of thermal conductivity (λ) increases with increase of pressure and the val. of K in the relation $\lambda = KC_v\eta$ increases with rise of temp. and decreases with increase of pressure. Tables are given showing the vals. of λ, η, and K at 200—500° and 1—250 atm. The vals. of Prandtl's criterion for the whole region investigated are also recorded. J. W. S.

Interrelationships between fluidity, volume, pressure, and temperature in liquids. E. C. Bingham, H. E. Adams, and G. R. McCauslin (*J. Amer. Chem. Soc.*, 1941, **63**, 466—474).—Fluidity–vol. curves of aliphatic alcohols obey the hyperbolic equation $V = A\phi - B/(\phi + D) + C$, where V is the vol., ϕ the fluidity, A, B, and D are consts., and $C = \Omega + AD$, where Ω is the mol. limiting vol. Lowering of ϕ by a given amount requires a different reduction in vol. depending on whether vol. is reduced by pressure or by cooling; this is due to the high elasticity of atoms and mols. Accordingly, two vols., $[C]_P$ and $[C]_T$ exist. $[C]_P$ represents the vol. of the mols. in one g.-mol. in the loosest form of close packing at which $\phi = 0$; $[C]_T$ represents the min. val. of mol. vol. when compression is applied, and ϕ again $= 0$. $[C]_T$ is independent of temp. The data for Hg are discussed. W. R. A.

Viscous and plastic flow. N. A. de Bruyne (*Proc. Physical Soc.*, 1941, **53**, 251—257).—Mathematical. Assuming a modulus of elasticity independent of temp., a relaxation time varying exponentially with temp., and an interaction between elastic strain energy and activation energy, the generalised expression derived for the relation between velocity gradient D and shearing stress S is $S = DGA\mathrm{e}^{(s_0 - s)^2 V/2GRT}$, where V is the vol. of a g.-mol., G is the modulus of rigidity, s is the external shear stress, and s_0 the max. cohesive stress. This equation is shown to be capable of representing the main types of viscous and plastic flow. N. M. B.

Brittleness of liquids. M. Kornfeld and M. Rivkin (*J. Physics U.S.S.R.*, 1940, **2**, 183—185).—Very brief exposure photographs indicate that when a stream of a rosin–transformer oil mixture of $\eta \sim 5 \times 10^3$ poises is deformed with a rate of impact of ~23 m. per sec. (rotating arm) or ~300 m. per sec. (rifle bullet) it undergoes brittle destruction. J. W. S.

Phenomenological theory of the mechanical properties of amorphous bodies. J. Frenkel and J. Obrastzov (*J. Physics U.S.S.R.*, 1940, **2**, 131—142).—A generalisation of Maxwell's relaxation theory of the elasticity of η of amorphous bodies, including a vol. η as well as the ordinary shearing η, is developed. The theory explains the abnormally large absorption of ultrasonic waves in liquids and the reversible shearing elasticity in addition to the irreversible process. The mol. mechanism of the vol. η is discussed. J. W. S.

Diffusion of water vapour through a slit in an impermeable membrane. J. D. Babbitt (*Canad. J. Res.*, 1941, **19**, **A**, 42—55).—It is shown mathematically that the mass (W) of vapour diffusing through unit length of a slit of width $2f$ from a pressure p_1 at a distance β on one side of the slit to a pressure p_0 at an equal distance on the other side is given by $W = \frac{1}{2}\pi D \,.\, \log \{(P - p_1)/(P - p_0)\}/\log (2\beta/f)$, where $D =$ diffusion coeff. and $P =$ atm. pressure. Experimental results for the diffusion of H_2O vapour through slits in Al foil between sheets of fibre-board or plaster-board are in agreement with the theory. F. J. G.

Self-diffusion in zinc. F. R. Banks (*Physical Rev.*, 1941, [ii], **59**, 376—381).—Using long-lived radioactive ^{65}Zn as an indicator, measurements of self-diffusion along the C axis of Zn single-crystals were made at six different temp. The activation energy is 19,600 g.-cal. per mol., and the diffusion coeff. at 410·4° is $9{\cdot}89 \times 10^{-4}$ sq. cm. per day. N. M. B.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

The characteristics of thermal diffusion. S. Chapman (*Proc. Roy. Soc.*, 1940, **A**, **177**, 38—62).—When a gas mixture is contained in a vessel in which a temp. gradient is maintained, a concn. gradient is in general set up. The paper discusses the dependence of the thermal diffusion ratio on (*a*) the ratio of the mol. masses, (*b*) the concn. ratio, (*c*) the ratio of the mol. diameters, and (*d*) three parameters depending on the mode of interaction of unlike mols. Certain special cases are considered in some detail. G. D. P.

Pressure–volume–temperature relations in solutions. IV. Apparent volumes and thermal expansibilities of sodium chloride and sodium bromide in aqueous solutions between 25° and 95°. R. E. Gibson and O. H. Loeffler (*J. Amer. Chem. Soc.*, 1941, **63**, 443—449; cf. A., 1939, I, 605).—Sp. vols. of aq. NaCl and NaBr have been measured throughout the whole concn. range at 10° intervals between 25° and 95°; the sp. vol. is a function of temp. and concn. From these data thermal expansibilities, and the apparent and partial mol. vols. and expansibilities, have been calc. The main differences between the two solutions arise from the larger polarising power of the Cl′ ion. The Br′ ion has a greater effect in breaking down the H_2O structure than has the Cl′ ion. W. R. A.

Apparent and partial molal volumes of the sodium salts of formic, acetic, propionic, and *n*-butyric acids in aqueous solution. G. M. Watson and W. A. Felsing (*J. Amer. Chem. Soc.*, 1941, **63**, 410—412).—ρ for aq. solutions of Na salts of HCO_2H, AcOH, $EtCO_2H$, and Pr^aCO_2H have been determined at 25°, 30°, 35°, and 40°. The apparent and partial mol. vol. have been deduced; the apparent mol. vol. of CH_2 at infinite dilution is ~14·6 ml. and increases slightly with increasing concn. W. R. A.

Measurement and explanation of so-called "crystallisation force." C. W. Correns and W. Steinborn (*Z. Krist.*, 1939, **101**, 117—133).—The pressure (p) developed in a supersaturated $KAl(SO_4)_2,12H_2O$ (**I**) solution during crystallisation at const. vol. has been calc. from vals. of the vol. change on crystallisation at atm. pressure. $p \propto c/c_s$, where c is the concn. of (**I**) in the solution and c_s its saturation concn. at the prevailing temp. An apparatus is described for measurement of the max. pressure (P), applied by a flat plate, against which a given face of a (**I**) crystal will grow; thermodynamic treatment gives $P = (RT/V) \log_e (c/c_s)$ [$V =$ mol. vol. in cryst. (**I**)], but interfacial tensions (γ), which depend on the material of the plate (glass, mica, gypsum), reduce P or may entirely suppress growth of the face under pressure. The experiments show that the γ vals. for the solution and the {111}, {110}, and {100} faces of a (**I**) crystal are different. Experiments demonstrating the development of pressure by crystallisation and hydration are described. A. J. E. W.

Electrical properties of solids. VI. Dipole rotation in high polymerides. VII. System polyvinyl chloride–diphenyl. R. M. Fuoss. **VIII. Dipole moments in polyvinyl chloride–diphenyl systems.** R. M. Fuoss and J. G. Kirkwood (*J. Amer. Chem. Soc.*, 1941, **63**, 369—378, 378—385, 385—394; cf. B., 1939, 1261).—VI. The a.c. properties at 60—10,000 cycles per sec. over the temp. range −30° to 120° have been determined for the systems: polyvinyl chloride (**I**); (**I**)–Ph_2 80 : 20; polystyrene (**II**); (**II**)–*p*-chlorodiphenyl (**III**) 90 : 10 and 80 : 20; poly-*p*-chlorostyrene (**IV**) alone and with varying amounts of Ph_2, *p*- (**V**) and *o*-chlorodiphenyl (**VI**) and mixtures of (**V**) and (**VI**). The primary effect of changing temp. is to change the internal η. The characteristic max. in absorption and dispersion of ϵ is determined by (*a*) the size and strength of the polar group, (*b*) the length and flexibility of the bond of the polar group to the polymeride chain, and (*c*) the nature and amount of a second component present as a plasticiser. Results suggest that the fundamental mechanism of a.c. response is dipole rotation in a medium of high η with an internal rotatory Brownian motion. For (**I**) a transition temp. at 70—75° exists and an internal melting process appears to occur.

VII. The system (**I**)–Ph_2 has been studied from −70° to 100° at 60—10,000 cycles per sec. and 0—20% of Ph_2. Results are in accord with theory and it is concluded that (*a*) the low-temp. absorption in polar polymerides is reduced and finally eliminated by the addition of a second component, (*b*) the a.c. loss factor, ϵ'', as a function of composition for a given frequency f and temp. passes through a max. at a concn. characteristic of a given plasticiser, and (*c*) the electric properties are markedly non-linear in the low-concn. range of composition.

VIII. A method is given whereby the distribution of times of relaxation of a polar system can be calc. from the observed ϵ''–f curve. The reduced polarisation is introduced as a simplification in calculating a.c. properties of polar systems. The average moment per monomeride unit of a linear polar polymeride, assuming free rotation, is $\sqrt{3}\mu_0/2$, where μ_0 is the moment of the equiv. group in free space. The experimental ϵ''–f curves for (**I**) can be represented empirically by an equation. A val. of 2·0 for the average moment of C–Cl in (**I**) has been found. W. R. A.

Relation of density and refractive index to composition of glass.—See B., 1941, I, 101.

***X*-Ray study of potash–silica glass.** J. Biscoe, M. A. A. Druesne, and B. E. Warren (*J. Amer. Ceram. Soc.*, 1941, **24**, 100—102).—A Fourier analysis of the *X*-ray diffraction pattern intensity curves of two K_2O–SiO_2 glasses (K_2O 20·9 and 29·1%) indicated a structure similar to that of the Na_2O glasses (B., 1938, 1036), each Si atom being tetrahedrally bonded to 4 O atoms with each O atom bonded to either 1 or 2 Si atoms. The K atoms are situated in holes in the network with an average of ~10 O neighbours. J. A. S.

Structure of solid glasses as revealed by electrical conductivity. R. L. Muller (*Bull. Acad. Sci. U.R.S.S., Sér. phys.*, 1940, **4**, 607—615).—If the conductivity κ of the system M_2O–B_2O_3 in the amorphous state at 250° is plotted against the vol. concn. c of the alkali metal (g.-ion per c.c.), the points for M = Li, Na, K, Rb, Cs, and Ag at $c > 0{\cdot}01$ fall on one curve; the individual properties of ions are important at $c < 0{\cdot}01$. Cations in glass are either near an ionised O and immobile, or near a non-ionised O and mobile. The equilibrium between mobile and immobile cations is calc.; its variation with c accounts quantitatively for the κ–c relation. The temp. coeff. of κ depends on the energy of dissociation of O–M bonds; this energy falls from about 70 to about 35 kg.-cal. when c increases from 0·005 to 0·02. The κ at 250—300° of glasses containing Na and K in the total concn. of 0·017 changes with the ratio [Na] : [K] so as to suggest that these glasses are non-homogeneous mixtures of Na borate and K borate. J. J. B.

Structure of liquid binary mixtures of glasses and salts as revealed by their viscosity and electrical conductivity. E. S. Evstropiev (*Bull. Acad. Sci. U.R.S.S., Sér. phys.*, 1940, **4**, 616—626).—In the graph log η against mol.-% p straight lines are obtained if the system forms only a eutectic; if a chemical compound is formed two straight lines are observed making an angle at the composition of the compound. A similar rule holds for conductivity and p. It is confirmed for $Na_2Si_2O_5$–$PbSiO_3$, Na_2SiO_3–$PbSiO_3$–SiO_2, and PbO–SiO_2. Published data for salt mixtures (*e.g.*, $TlNO_3$–$AgNO_3$ and KCl–$MgCl_2$) also confirm it. Some exceptions (*e.g.*, LiCl–KCl) are also found. The results are best accounted for by the assumption that liquid glasses are " micro-heterogeneous " mixtures of several components. J. J. B.

The work of the State Optical Institute on the structure of glass. I. V. Grebenstschikov (*Bull. Acad. Sci. U.R.S.S., Sér. phys.*, 1940, **4**, 579—583).—Transformations occur in glass at very low temp. Glasses rapidly cooled from 85—120°, 140—165°, and 180—210° have different refractive indices presumably connected with transitions $\alpha \rightarrow \beta \rightarrow \gamma$ of tridymite and $\alpha \rightarrow \beta$ of cristobalite. Some borosilicates when annealed can be dissolved in acids, leaving a skeleton of SiO_2 with an admixture of B_2O_3 and Na_2O. Fire-polished tubings of the same glass only crack in acids; the cracks are normal to the length of tubing. This indicates an orientation of mols. in glass. J. J. B.

Structure of glass derived from *X*-ray analysis and study of optical properties. A. A. Lebedev (*Bull. Acad. Sci. U.R.S.S., Sér. phys.*, 1940, **4**, 584—587).—Annealing of glasses of the system Na_2O–SiO_2 reveals two blurred max. corresponding with SiO_2 (cristobalite or tridymite) and Na_2SiO_3. Presumably crystals of these compounds, 7 to 15 A. in length, are always present in glass; their transformation causes changes of n on annealing at definite temp. (see preceding abstract). J. J. B.

Elastic and viscous properties of several potash–silica glasses in the annealing range of temperature. N. W. Taylor and R. F. Doran (*J. Amer. Ceram. Soc.*, 1941, **24**, 103—109).—Measurements of η and elastic elongation similar to those previously made on Na_2O–SiO_2 glasses (B., 1937, 1204) were made on fibres of K_2O–SiO_2, K_2O–CaO–SiO_2, and Na_2O–CaO–SiO_2 glasses at the annealing temp. The delayed elastic distortion, which is more complex than in the Na_2O–SiO_2 series, is represented by the two-term form $l_0\ (1—e^{kt})$, indicating that > one kind of " molecule " is oriented by the tensional stress, and is associated with an activation energy of 57—96 kg.-cal. (< that of Na_2O–SiO_2 glasses). The activation energy of viscous flow, which is 105 kg.-cal. (150 for Na_2O–SiO_2 series), is independent of the K_2O content and is determined by the K–O bond. The mechanism of elastic deformation is discussed from the mol. viewpoint. J. A. S.

Vitreous state. O. K. Botvinkin (*Bull. Acad. Sci. U.R.S.S., Sér. phys.*, 1940, **4**, 600—603).—Glasses consist of chemically homogeneous aggregates. *X*-Ray patterns of glasses are due to incipient devitrification. Only spacings of SiO_2 and $NaBO_2$ are revealed by *X*-rays or electrons since only these substances have a high rate of formation of nuclei and, therefore, form numerous crystals. $Na_2Si_2O_5$, $Na_2Ca_3Si_6O_{16}$, etc. form few large crystals and cannot be detected. J. J. B.

Crystallisation in silicate slags and glasses. E. Preston (*Trans. Faraday Soc.*, 1941, **37**, 209—220).—In the binary eutectic range of materials such as technical glasses and slags the individual cryst. characters of each phase are retained, in contrast to the observed behaviour of metals. The growth of certain cryst. species from glass in relation to time and temp. is illustrated by diagrams. At temp. below that of max. crystallisation velocity (T_M) there is a linear relation between log v and $1/T_{abs.}$ (v = initial rate of crystal growth). The empirical equation $v = K(1/\eta)^2(T_L - T)$, in which the liquidus temp. is denoted by T_L, is valid for temp. below and above T_M and appears to be applicable, with a suitable const. K, to crystal growth in a wide range of silicate glasses. F. L. U.

Transformations in eutectoid copper–aluminium alloys. IV. Reversibility of the martensite transformation $\beta_1 \rightarrow \gamma'$. G. Kurdjumov and V. Miretzki (*J. Physics U.S.S.R.*, 1940, **2**, 143—145).—*X*-Ray examination of a Cu–Al alloy (Al 14·5%) after quenching shows the presence of a β_1 phase (Cu_3Al) at room temp. but only of the γ' phase at liquid air temp. After again warming to room temp. the β_1 phase only is present. With an alloy containing 13·3% of Al, for which the $\beta_1 \rightarrow \gamma'$ change occurs at ~190°, the reverse change occurs on heating at > ~350°. J. W. S.

Hall effect and other physical properties of the copper–tin system of alloys. G. G. Andrewartha and E. J. Evans (*Phil. Mag.*, 1941, [vii], **31**, 265—282).—The d, resistivity, temp. coeff. of resistance, thermo-electric power, and Hall coeffs. of 34 annealed Cu–Sn alloys have been determined. The results are discussed in relation to the position of the phase boundaries (Cu_4Sn, Cu_3Sn, CuSn). The slopes of the resistivity–composition curve and the temp. coeff. of resistance–composition curve show abrupt changes at the phase boundaries. This is also the case for the curve of thermo-electric power against composition, but a max. occurs in this curve at Cu 95% which is not evident in any of the other curves. The d–composition curve does not show marked changes at the phase boundaries. The curve of Hall effect against composition shows change of slope at the phase boundaries, and indicates that the effect is closely connected with the structure and composition of the alloys. Although the Hall coeffs. of both Cu and Sn are negative, the coeffs. for alloys in the neighbourhood of Cu_4Sn and Cu_3Sn have much larger positive vals. Alloys containing ~44 and 74% of Cu respectively have zero Hall coeff. There is evidence from the Hall effect of the existence of a narrow phase extending from ~61·2—63% of Cu. The limit of solubility of Sn in Cu is 14%. A. J. M.

Diffusion in α-solid solutions of aluminium.—See B., 1941, I, 186.

Structure and properties of iron–nickel alloys.—See B., 1941, I, 107.

Migration of atoms in iron–nickel alloys. E. A. Owen and A. H. Sully (*Phil. Mag.*, 1941, [vii], **31**, 314—338).—The vals. of lattice parameters of samples of Fe–Ni alloys quenched from temp. between 500° and 800° are independent of the annealing temp., but quenching must be rapid and efficient to ensure uniform results. For specimens ranging from pure Ni to 27 at.-% of Ni, quenched from the above temp. to 0°, the addition of Fe causes the Ni lattice to expand almost linearly with at. composition. The lattice parameter reaches a max. of 3·5889 A. at 15° for an alloy containing 38·6 at.-% of Ni; this max. is at a composition approximating to that of the intersection of the magnetic transformation curve and the γ–($\gamma + \alpha$) boundary, and suggests that the shape of the parameter–composition curve is affected both by the phase boundary and by the position of the magnetic transformation curve. The parameter is unaffected by time of annealing provided this is > a min. period. Difficulties formerly encountered in the determination of the lattice parameter in the two-phase system are due to unsuitability of heat-treatment, and the use of radiation of unsuitable λ. In this region, the curves between composition and parameter of alloys annealed at 500°, 400°, and 350°, respectively, were of different shapes for both α and γ components, according to the heat-treatment to which the alloys had been subjected. The heat-treatment can be varied so as to make Ni atoms migrate either from the α to the γ structure, or vice-versa. α-phase nuclei are formed, which are small enough in the initial stages to cause particle scattering of the incident radiation, although this component appears to be in equilibrium corresponding with the temp. of annealing. The γ phase does not attain equilibrium with the same readiness, or else the nuclei of the γ phase are even smaller than those of the α phase. A. J. M.

Solubility of carbon dioxide and nitrous oxide in aqueous salt solutions. A. E. Markham and K. A. Kobe (*J. Amer. Chem. Soc.*, 1941, **63**, 449—454).—Solubilities at 0·2°, 25°, and 40° have been measured for CO_2 in various concns. of aq. KCl, NaCl, KNO_3, $NaNO_3$, $Mg(NO_3)_2$, $MgSO_4$, Na_2SO_4, and for N_2O in all except aq. $NaNO_3$. A new equation is proposed which expresses solubility in terms of concn. Reduction in solubility is an additive function of ion concn. up to 1·0M. W. R. A.

Crystal growth. II. D. Balarev and N. Kolarov (*Z. Krist.*, 1939, **101**, 156—160; cf. A., 1939, I, 195).—Further experiments with gypsum at 23° show that the solubility vals. for rising (s_r) and falling temp. (s_f) differ by $\ngtr\sim 2\%$. If the crystals carry no freshly-deposited material the direction of stirring has little or no effect on s, but if crystals freshly deposited from the solution under given stirring conditions are present, reversal of the direction of stirring raises s_r and lowers s_f; s_r may then be $>s_f$. These facts are explained in terms of a general theory of crystal growth. A. J. E. W.

Solubility of sucrose in organic solvents.—See B., 1941, III, 67.

Adsorption of hydrogen on reduced nickel. S. Iijima (*Sci. Papers Inst. Phys. Chem. Res. Tokyo*, 1941, **38**, 183).—Supplementary notes on previous work (A., 1939, I, 365). Both adsorption and desorption of H_2 on reduced Ni by change in temp. are irreversible. Adsorbed H_2 can be desorbed by evacuation at low temp. only with difficulty. If Ni is reduced at high temp. activated adsorption decreases markedly and van der Waals adsorption slightly. Reduction of Ni at 280° is incomplete. Max. and min. points on the adsorption isobar should shift according to the activity of reduced Ni and the pressure of gas. Van der Waals adsorption is responsible for nearly all the H_2 adsorbed on reduced Ni at −183°. W. R. A.

Catalytic activity, crystal structure, and adsorptive properties of evaporated metal films. O. Beeck, A. E. Smith, and A. Wheeler (*Proc. Roy. Soc.*, 1940, **A**, **177**, 62—90).—Films of Ni condensed on glass were found to be highly oriented if the condensation had taken place in an inert gas such as N_2 or A at 1 mm. pressure. Such films have twice the available surface of films evaporated in a vac. and are five times as active. The activity, measured by the hydrogenation of C_2H_4, increases with film thickness, suggesting that the interior of the film participates in the catalysis and that it must therefore be porous. Adsorption isotherms for C_2H_4, CO, N_2, H_2, and O_2 were obtained and the poisoning of the catalyst by CO and O_2 was studied. Films of Fe, Co, Pd, Pt, and Cu were also investigated and, with the exception of Cu, gave similar results. G. D. P.

Hysteresis in sorption. I. Permanence of the hysteresis loop. Titania gel–water system. II. Scanning of the hysteresis loop. Titania gel–water system. III. Permanence and scanning of the hysteresis loop. Silica gel–water system. IV. Permanence and scanning of the hysteresis loop. Silica gel–carbon tetrachloride system. V. Permanence, drift, and scanning of the hysteresis loop. Ferric oxide gel–carbon tetrachloride and ferric oxide gel–water systems. VI. Disappearance of the hysteresis loop. Rôle of elasticity of organogels in hysteresis in sorption. Sorption of water on some cereals. K. S. Rao (*J. Physical Chem.*, 1941, **45**, 500—506, 506—512, 513—517, 517—521, 522—531, 531—539).—I. During the successive sorption and desorption of H_2O by TiO_2 gel at 30° a permanent and reproducible hysteresis loop is exhibited. No explanation other than that based on the concept of cavities with restricted ends satisfactorily explains the data. A slight drift in the loop due to ageing of the gel takes place after a few months. Ageing appears to take the form of compression of the restricted ends of the cavities.

II. The Langmuir and Williams–Henry unimol. adsorption equations when applied to the data show a clear transition from unimol. adsorption to capillary condensation. The result of scanning the hysteresis loop supports the cavity explanation of hysteresis. The adsorption curve is the true equilibrium curve because during desorption the cavities retain H_2O in a metastable equilibrium.

III. A similar hysteresis loop is exhibited in the adsorption of H_2O by SiO_2 gel at 30° although there is no tendency to drift during ageing. The loop lies within the limits of R.H. 0·35 and 0·94 corresponding with capillary radii of 10 and 160 A.

IV. A permanent and reproducible loop is exhibited in the sorption and desorption of CCl_4 by SiO_2 gel at 30°. The extent of sorption at saturation pressure and the area of the loop are < in the case of H_2O, suggesting that some of the capillaries in the gel are inaccessible to CCl_4.

V. The hysteresis loop in the sorption and desorption of H_2O by Fe_2O_3 gel tends to drift during ageing, but the loop in the sorption of CCl_4 by the same gel shows no such tendency. In the former case the sorptive capacity and the area of the loop continually decrease, indicating a decrease in capillary and cavity vol. respectively. The difference between the behaviour of Fe_2O_3 gel towards H_2O and that of SiO_2 and TiO_2 gels is possibly due to coalescence of the colloidal particles of Fe_2O_3 into larger aggregates.

VI. Activated grains of rice and dhal show a hysteresis loop during sorption and desorption of H_2O at 30° which they lose after a few sorptions and desorptions. When H_2O is replaced by CCl_4 the loops are permanent and reproducible. The behaviour with H_2O appears to be connected with the swelling of the grains on the imbibition of H_2O whereby they become elastic and lose their property of entrapping H_2O in the cavities. C. R. H.

Adsorption at crystal–solution interfaces. XI. Adsorption of isomeric monoazo-dyes by crystals of sodium nitrate, sodium bromate, and sodium chlorate during their growth from solution. W. G. France and K. M. Wolfe (*J. Physical Chem.*, 1941, **45**, 395—401).—Adsorption of 86 acid and basic dyes and the modification in certain instances of crystal habit are described. Although the mol. structure of the dye is some guide to whether adsorption or crystal modification will take place, no simple rule can be formulated. C. R. H.

Application of Gibbs adsorption equation to solutions of paraffin-chain salts. F. A. Long and G. C. Nutting (*J. Amer. Chem. Soc.*, 1941, **63**, 625—627).—The paradox of aq. paraffin-chain salts having $\gamma \ll \gamma$ of H_2O, whilst calculation from the Gibbs equation indicates a negative surface excess of solute, is considered. The paradox is more apparent than real, for whilst positive adsorption at the air–liquid interface results in a surface layer of solute, the Gibbs surface excess may be positive, zero, or negative, depending on the conditions. It is concluded that the Gibbs equation in its usual form is valid for solutions of paraffin-chain salts as for other two-component solutions. W. R. A.

Significance of the forms of union for the desorption of cations. N. I. Gorbunov (*Pedology*, 1940, No. 3, 54—67).—The three forms of union (covalent, ionic, and polar) between ions, mols., and their aggregates are described. Experimental data showing the direct and indirect significance of the forms of union for the desorption of cations from the adsorbed state are discussed. S. and F. (*m*)

Surface tension of aqueous perchloric acid at 15°, 25°, and 50° c. C. A. Neros and W. G. Eversole (*J. Physical Chem.*, 1941, **45**, 388—395).—With increase in concn. γ decreases to a min. at ~40% of $HClO_4$ and rises to a sharper max. at ~65% of $HClO_4$, the latter point corresponding with $HClO_4,3H_2O$. γ decreases with temp. but the form of the γ–composition curves remains the same. The initial lowering of γ is attributed to the formation of a H bond at the interface. C. R. H.

Interfacial activity of branched-paraffin-chain salts. G. S. Hartley (*Trans. Faraday Soc.*, 1941, **37**, 130—133).—Theory indicates that the formation of micelles in solutions of paraffin-chain salts should be hindered if for the *n*-paraffin chain were substituted one containing the same no. of C atoms in two approx. equal branches. A salt of this kind would be expected to produce a greater lowering of the oil–H_2O interfacial tension (γ) than that caused by the corresponding *n*-chain salt. These predictions are confirmed by a comparison of dialkyl ethers of K resorcinolsulphonate with K *n*-hexadecoxytoluenesulphonate (**I**), the former containing alkyl groups with 14 + 2 (**II**), 12 + 4 (**III**), 10 + 6 (**IV**), and 8 + 8 (**V**) C atoms. At a concn. of 0·01% (**I**) is more effective than any of the branched-chain compounds, and more effective than (II) and (III) at higher concns. At 0·02% and higher concns. (IV) and (V) are superior to (I), (V) being the most effective. Thus at 0·08% γ for H_2O–*cyclo*hexane was reduced to 1·12 dyne per cm. by (I) and to 0·04 dyne per cm. by (V). F. L. U.

Interfacial tension, viscosity, and potential changes produced by insoluble monolayers at the oil/water interface. A. E. Alexander (*Trans. Faraday Soc.*, 1941, **37**, 117—121).—Experimental methods of measuring the properties named and the results so far obtained are summarised. For small reductions of the interfacial tension the areas per mol. at an oil–H_2O interface are $\gg$ at an air–H_2O interface, but with increasing interfacial pressure the two areas approach until finally an identical packing is observed. Considerable information about the behaviour of monolayers at an oil–H_2O interface is obtainable from experiments with an air–H_2O interface. F. L. U.

Horizontal orientation and solvation of molecules in adsorption layers. A. B. Taubman (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 22—26).—The surface tension isotherms for solutions of hydrocarbons: C_6H_6, $C_{10}H_8$, $C_{16}H_{31}Ph$, C_6H_{14}, $C_{10}H_{22}$, cetene, and *cyclo*hexane, in $PhNO_2$ have been determined and compared with those of $Bu^{\alpha}OH$, n-$C_8H_{17}\cdot OH$, $Pr^{\alpha}CO_2H$, $C_9H_{19}\cdot CO_2Et$, and Et_2 sebacate (I) in $PhNO_2$. The isotherms of the polar compounds, with the exception of (I), deviate from Sziszkowski's equation (A., 1908, ii, 1018) at low concn., indicating that cohesion forces between the chains become important at low concn. The mol. consts. of these compounds indicate that they are oriented vertically in the surface. The non-polar compounds obey Sziszkowski's equation at all concns., indicating that these compounds are completely solvated and that they are oriented horizontally. This is confirmed by calculation of the thickness d of the adsorption layer and the area A occupied per mol. For the non-polar hydrocarbons d is const. in a homologous series, while A increases with chain length. The horizontal orientation of (I) is ascribed to the symmetrical position of the polar groups. O. D. S.

Effect of salts on soluble ionised monolayers. A. B. D. Cassie and R. C. Palmer (*Trans. Faraday Soc.*, 1941, **37**, 156—168).—A theory is developed and expressions are derived for the distribution of ions under a monolayer of a surface-active strong electrolyte. The theory is in quant. agreement with data on the effect of added electrolytes on the interfacial properties of such films and explains the fact that an appreciable effect is caused only by ions of opposite sign to the film. Surface equations of state, surface potentials, the work of adsorption, and the crit. concn. for micelle formation are discussed with reference to the theory. F. L. U.

Orientation at the oil–water interface of esters and their digestion by pancreatin. J. H. Schulman (*Trans. Faraday Soc.*, 1941, **37**, 134—139).—The results obtained by Williams (A., 1940, I, 440) on the electrophoresis of aliphatic ester emulsions are interpreted in terms of the mol. configuration of the esters, in agreement with conclusions previously reached on the basis of measurements of the rate of hydrolysis by NaOH of esters spread as monolayers at the air–H_2O interface (A., 1937, I, 562). Measurements of the rate of digestion of a series of esters by pancreatin show that the accessibility of the ketonic C atom to the enzyme is determined chiefly by the length of the acid chain. Thus esters of acids C_2, C_3, and C_4 are digestible, C_5, C_6, and BzOH indigestible, and C_8 digestible. Lengthening of the alcohol chain has an adverse influence on the digestible esters but no influence on the indigestible. Pictures of the oriented mols. are given in which the ketonic C is shown exposed to attack by the assumption of a *cis* configuration by the acid and alcohol chains, and protected by the assumption of a *trans* configuration. The lipoclastic action of pancreatin is inhibited by long-chain sulphates but assisted by other types of capillary-active salts, the latter action being due to protein dispersion. F. L. U.

Cell permeability and diffusion across the oil–water interface. J. F. Danielli (*Trans. Faraday Soc.*, 1941, **37**, 121—124).—A simple theory of the permeability (P) of thin ($\sim$50 A.) oil layers by aq. solutes of the type $R(OH)_x$ is put forward and expressions for P are derived. Vals. of the P of five typical cells for $(CH_2\cdot OH)_2$, glycerol, and erythritol are of the same order of magnitude as the vals. calc. on the theory for a layer of oil having $\eta \sim 10^5$ times that of H_2O. F. L. U.

Mechanism of boundary lubrication. I. Action of long-chain polar compounds. O. Beeck, J. W. Givens, and A. E. Smith. **II. Wear prevention by addition agents.** O. Beeck, J. W. Givens, and E. C. Williams (*Proc. Roy. Soc.*, 1940, **A**, **177**, 90—102, 103—118).—I. The structure of thin films of lubricant rubbed on polished mild steel surfaces was investigated by electron diffraction. Those lubricants showing little or no surface orientation have a const. coeff. of friction (μ) $\sim$0·1. With oils which show high surface orientation imparted by the addition of a long-chain polar compound a sudden decrease of μ is observed at a crit. velocity depending on the compound used. The effect is explained by the wedging of oil under the surface, and it was shown that the electrical resistance between the sliding surfaces becomes very great when μ decreases. The experiments show that the long-chain compounds act by inducing the wedging effect and do not protect the surfaces from wear.

II. The action of wear-preventing agents is connected with their polishing action. The elements of group V of the periodic table are particularly effective; they form a metallic phosphide or homologue on the surface, lowering its m.p. markedly and thus aiding in maintaining polish. Accurate measurement of wear was carried out by using metal-plated steel balls as the sliding elements. The addition of 1·5% of PPh_3 or $AsPh_3$ in white oil reduces wear by factors of 7·2 and 12·2; this reduction can be doubled by the addition of 1% of a long-chain polar compound. G. D. P.

Physico-chemical foundations of flotation of native metals.—See B., 1941, I, 109.

Hydration of carbon dioxide and stability of hypochlorite aërosols. P. V. Youle (*Nature*, 1941, **147**, 59).—A comment on recent work (cf. A., 1941, III, 306). L. S. T.

Factors governing the stability of oil-in-water emulsions. A. King (*Trans. Faraday Soc.*, 1941, **37**, 168—180).—Recent work by the author and others on oil-in-H_2O emulsions is reviewed. The principal conclusions are that stability depends chiefly on the presence of a complete and mechanically strong interfacial film, and that as the concn. of the emulsifying agent is increased the character of an emulsion changes from hydrophobic to hydrophilic; when the globules are surrounded by a complete film of emulsifier the electrical stability factor becomes relatively unimportant and the emulsion then resembles a protected colloid. F. L. U.

Stabilisation of water-in-oil emulsions by oil-soluble soaps. R. C. Pink (*Trans. Faraday Soc.*, 1941, **37**, 180—184).—When 2% solutions of certain oleates and stearates in C_6H_6 are shaken with H_2O, Ni and Zn oleates are unaffected, Mg oleate and Mg stearate are almost wholly removed from solution, and Ca and Sr oleates and Ni stearate are partly removed. If these soaps are used as emulsifiers by shaking their C_6H_6 solutions with an equal vol. of H_2O there is an exact correlation between their emulsifying power and the pptn. referred to; thus Mg oleate and Mg and Ni stearates form stable emulsions, Ca and Sr oleates poor emulsions, and Ni and Zn oleates no emulsions. An oil-sol. soap acts as an emulsifier for H_2O-in-oil emulsions only when it is pptd. from its oily solution by H_2O, and when the pptd. soap is insol. in both phases. Further necessary conditions are that the soap must be partly wetted by both liquids, and that there is sufficient lateral adhesion between the solid particles. F. L. U.

Preparation of purified kaolinite suspension.—See B., 1941, I, 176.

Ionic size in relation to fixation of cations by colloidal clay.—See B., 1941, III, 116.

Viscosity and the nature of substances of high mol. wt. in solution. F. Eirich (*Physical Soc. Rep. Progr. Physics*, 1940, **7**, 329—254).—A progress report. W. J.

Crystallisation phenomena in raw rubber.—See B., 1941, II, 165.

Non-isothermal gel–sol–gel transformation of mixed gelatin–methylcellulose systems. W. Heller (*J. Physical Chem.*, 1941, **45**, 378—388).—Mixed colloidal dispersions of gelatin (I) and methylcellulose (II) in H_2O form coacervates. The two phases behave independently, (I) or (II) sols setting to a gel according to whether the system is cooled or heated. If the

system is shaken and immediately cooled, a complete gel is formed without separation, and if the system is heated after shaking a similar complete gel is also formed. In the former case the (I) gel can include ~85 vol.-% of (II) sol, and in the latter the (II) gel can include ~30 vol.-% of (I) sol. The behaviour is only slightly influenced by p_H changes. Changes in transparency with reduction in temp. suggest that (I) and (II) influence the degree of hydration of each other, the probability being that (I) dehydrates (II).
C. R. H.

Refractive indices of protein solutions. S. Shinano (*J. Agric. Chem. Soc. Japan*, 1941, **17**, 115—121).—n_D vals. for solutions of crab flesh proteins in aq. NaOH are recorded. With const. amounts of NaOH and varying amounts of proteins, or with varying amounts of NaOH, n_D is not $\propto$ the concn. of protein.
J. N. A.

Keratin chemistry.—See B., 1941, II, 142.

Combination of wool protein with acid and base.—See B., 1941, II, 77.

Breaking strength of lyogels. C. R. Bailey (*J. Physical Chem.*, 1941, **45**, 493—500).—The breaking strength (*S*) of gels containing various proportions of Wyoming bentonite in H_2O with and without K_2SO_4 has been investigated. *S* increases with increase in clay content, the increase being approx. linear above 6% of clay. Mixtures containing $<\sim$3% of clay show no detectable *S*. This mixture has been termed a "prime suspension." If K_2SO_4 is added to the prime suspension *S* increases. Starting with the prime suspension the change in concn. of additional clay bears a const. ratio to the change in concn. of K_2SO_4 which will induce the same change in *S*. From this it is argued that it is the charge on the additional clay particles which causes gelation, and that at low concns. it is the amount of charge which determines gelation irrespective of whether it is carried by a small mobile ion or by a large flat clay particle. The rate of change of *S* with time $\propto$ *S*, so if it is assumed that $S \propto$ no. of oriented clay particles, then the rate of orientation of such particles $\propto$ no. of particles already oriented in the gel structure.
C. R. H.

Effect of p_H on the electrophoretic mobility of emulsions of certain hydrocarbons and aliphatic halides. W. Dickinson (*Trans. Faraday Soc.*, 1941, **37**, 140—148).—The substances examined were purified until they showed a const. mobility (*u*) which was not changed by further purification, and the same *u* vals. were obtained from emulsions prepared in three different ways. n-$C_{18}H_{38}$ and paraffin wax give u–p_H curves that coincide up to p_H 5·5, above which they diverge slightly. The curves for $C_8H_{17}I$ and $C_{16}H_{33}I$ coincide throughout the whole p_H range studied, viz., 2—12, whilst that for $C_{16}H_{33}Br$ diverges above p_H 4 to lower *u* vals. The curves for $C_{12}H_{25}Cl$, $C_{16}H_{33}Cl$, and $C_{18}H_{37}Cl$ coincide throughout the entire range. All the substances have a slight positive charge at p_H 2, and this is reversed between p_H 2 and 3 and thereafter becomes increasingly negative with rising p_H. The curves are all concave to the p_H axis, and those for the halides become relatively flat beyond p_H 8. The source of the negative charge and the effect on *u* of the nature of the end-group are discussed.
F. L. U.

Anomalies between electrophoretic mobility and interfacial tension data for paraffin-chain salt solutions. J. Powney and L. J. Wood (*Trans. Faraday Soc.*, 1941, **37**, 152—155).—The lowering of interfacial tensions (γ) between H_2O and a hydrocarbon by $C_5H_5N{<}C_{12}H_{25}I$ is inappreciable at any concn. $<$0·01%, whereas the max. change in mobility is observed at 0·0004%. Similar discrepancies, though less marked, are found with $C_{12}H_{25}{\cdot}O{\cdot}SO_3Na$, $C_{14}H_{29}{\cdot}O{\cdot}SO_3Na$, and $C_{12}H_{25}{\cdot}CO_2Na$. Since the large changes in mobility must be presumed to be due to adsorption of paraffin-chain ions at the interface, it is difficult to explain why there is no corresponding lowering of γ.
F. L. U.

Properties of detergent solutions. XI. Electrophoretic mobilities in dodecylpyridinium iodide solutions. J. Powney and L. J. Wood (*Trans. Faraday Soc.*, 1941, **37**, 220—223).—Mobilities of Nujol droplets in aq. $C_5H_5N{<}C_{12}H_{25}I$ (I) at 25° and 60° are recorded. The emulsions are extremely sensitive to small concns., the mobility changing from $-4{\cdot}3$ to $+5{\cdot}5\ \mu$. per sec. over the concn. range 0—0·0002%. In very dil. solutions the mobility of the more hydrophilic particles of ilmenite and glass is relatively little affected. The effect of added electrolytes (Na_2SO_4, $MgSO_4$, $MgCl_2$, NaCl) has been studied. The behaviour of Nujol towards (I) closely resembles that observed with the chloride (A., 1940, I, 114), and the large effect produced by very small concns. is not accompanied by an appreciable lowering of interfacial tension (cf. preceding abstract).
F. L. U.

Electrophoresis of complex particles as a function of p_H. Effect of stearic acid in ester particles. G. Growney (*Trans. Faraday Soc.*, 1941, **37**, 148—151).—The mobilities of droplets of Et dodecoate containing various amounts of stearic acid do not lie between those of the constituents, and it is inferred that the orientation of the surface layer of stearic acid in the composite droplet differs from that in the pure acid. The effect of p_H on the mobility at various compositions and of composition at various p_H vals. is shown in curves.
F. L. U.

Electrophoresis of lipin-free blood serum.—See A., 1941, III, 386.

Valency effect in the electrophoresis of proteins computed by the Gronwall–La Mer theory. M. H. Gorin (*J. Physical Chem.*, 1941, **45**, 371—377).—Theoretical. In deriving the equation $v = v_0/(1 + \kappa r)$ where v = electrical mobility, $v_0 = v$ at infinite dilution, r = protein radius, and κ = ionic strength function, an assumption is made that a hyperbolic sine function equals its argument. This assumption has the effect that the decrease in v with ionic strength for a given net charge predicted from the approx. equation is $<$ that predicted from the more complete equation, the difference (*D*) disappearing at infinite dilution and at high salt concns. Applying the third-order correction of the Gronwall–La Mer theory it can be shown that *D* increases as the square of the charge and as $1/r^2$ for a given ionic strength. When the net charge on the protein is $<$5 valency units and when ionic strength is $>$0·1M., *D* is negligible.
C. R. H.

VI.—KINETIC THEORY. THERMODYNAMICS.

Structure of ferric thiocyanate and its dissociation in aqueous solution. H. E. Bent and C. L. French (*J. Amer. Chem. Soc.*, 1941, **63**, 568—572).—The coloured complex in Fe^{III} thiocyanate is $FeCNS^{\cdot\cdot}$. This has been shown by the dependence of mol. extinction coeffs. at const. p_H and ionic strength on the concn. of $Fe^{\cdot\cdot\cdot}$ and CNS' ions and by dilution experiments and experiments on ionic migration in an electric field. The dissociation const. of $FeCNS^{\cdot\cdot}$ has been calc. No evidence has been found for the ion $Fe(CNS)_6'''$, postulated by Schlesinger and van Valkenburgh (A., 1931, 670).
W. R. A.

Effect of substituents on the acid strength of benzoic acid. I. In methyl alcohol. II. In ethyl alcohol. III. In ethylene glycol and n-butyl alcohol. IV. In dioxan–water. J. H. Elliott and M. Kilpatrick (*J. Physical Chem.*, 1941, **45**, 454—465, 466—471, 472—485, 485—492).—I. The strengths of *o*-, *m*-, and *p*-substituted BzOH in MeOH where the substituent is NO_2, halogen, Me, OMe, and OH have been potentiometrically determined at 25°.

II. Data for the same acids in EtOH are recorded.

III. Data in $(CH_2{\cdot}OH)_2$ and $Bu^{\alpha}OH$ are recorded. The order of strength in each of the four solvents differs from that in H_2O and from the order in the remaining three solvents. A linear relation exists between acid strength and $1/D$ (D = dielectric const.) between D = 78 and 25, and agreement between calc. and observed vals. is good except for *o*-substituted acids in $(CH_2{\cdot}OH)_2$. Extrapolation to $1/D = 0$ gives the intrinsic acid strength, which should be independent of the solvent. The intrinsic strengths of *o*-substituted acids are $>$ for the corresponding *m*- and *p*-derivatives. In general the acid strength of *o*-substituted acids decreases and the strength of *m*- and *p*-substituted acids increases as $1/D$ increases with change of solvent.

IV. Acid strengths in H_2O–dioxan mixtures containing 26·5, 43·5, 61·0, and 73·5% of dioxan do not vary linearly with $1/D$, and have not the same vals. as in H_2O-alcohol mixtures of the same *D*.
C. R. H.

Activity coefficients of sodium and potassium fluorides at 25° from isopiestic vapour pressure measurements. R. A. Robinson (*J. Amer. Chem. Soc.*, 1941, **63**, 628—629).—Isopiestic v.p. measurements of the activity coeffs. of NaF and

KF at 25° have been made and compared with vals. calc. for 25° from f.p. data. Except at 2·0M. the agreement is tolerable. W. R. A.

Solubility studies. II. Activity product and standard electrode potential of silver iodate from 10° to 35°. III. Ionisation constant of iodic acid at 25°, 30°, and 35°. N. C. C. Li and Y. T. Lo (*J. Amer. Chem. Soc.*, 1941, **63**, 394—297, 397—399). —II. The solubility and activity coeffs. of $AgIO_3$ in aq. KNO_3 from 10° to 35° have been determined. The standard potential, ΔS^0, ΔH^0, and ΔC_p^0 of the Ag|$AgIO_3$ electrode, and ΔG^0, ΔS^0, ΔH^0, and ΔC_p^0 of the reaction $AgIO_3 = Ag^{\cdot} + IO_3'$ have been calc. for 5 temp. between 10° and 35°. The ionic entropy and heat capacity of IO_3' are, respectively, 29·6 entropy units and 13·6 g.-cal. per degree per mol. and are const. over the temp. range.

III. The solubility of $AgIO_3$ in aq. HNO_3 at 25°, 30°, and 35° has been determined. Combining these data with those from Part II, the dissociation const. of HIO_3 has been computed for the three temp. W. R. A.

Thermodynamics of bi-univalent electrolytes. VI. Solutions of cadmium iodide from 5° to 40°. R. G. Bates (*J. Amer. Chem. Soc.*, 1941, **63**, 399—404).—E.m.f. measurements have been made on the cell Cd–Hg (2 phase)|CdI_2 (0·002—2·0M.|AgI–Ag at 5° intervals from 5° to 40° and activity coeffs., relative partial mol. heat content, and relative partial mol. sp. heat L' have been evaluated. The e.m.f. varies linearly with temp. for [CdI_2] from 0·05 to 2·0M. and therefore L' is const. in this range. W. R. A.

Activity coefficients of silver and chromate ions in gelatin media. A. Van Hook (*J. Physical Chem.*, 1941, **45**, 422—431).—The apparent individual activity coeffs. of $Ag^{\cdot}$ and CrO_4'' in H_2O and in 1·5 and 3·0% gelatin have been determined. Both ions combine extensively with gelatin, combination decreasing as p_H decreases below the isoelectric point. The effect of added salts on the activity of $Ag^{\cdot}$ in gelatin is somewhat erratic but the effect on the activity of CrO_4'' is more regular and is of an interionic character. C. R. H.

Vapour-phase composition of carbon dioxide–water mixtures at various temperatures and at pressures [up] to 700 atmospheres. R. Wiebe and V. L. Gaddy (*J. Amer. Chem. Soc.*, 1941, **63**, 475—477).—The composition of the phase rich in CO_2 in equilibrium with the phase rich in H_2O has been determined at 25°, 31·04°, 50°, and 75° at pressures from 1 to 700 atm. and the behaviour of the system is discussed in connexion with the general thermodynamic equation of binary mixtures. W. R. A.

System naphthalene–*p*-nitrophenol: experimental investigation of all the variables in an equation of the f.p. curve. A. N. Campbell and A. J. R. Campbell (*Canad. J. Res.*, 1941, **19**, **B**, 73—85).—The sp. heat and heat of fusion of p-$OH{\cdot}C_6H_4{\cdot}NO_2$ (**I**) are $0{\cdot}248 \pm 0{\cdot}009$ g.-cal. per g. at 0—20°, and 41·7 g.-cal. per g., respectively. The heats of mixing with $C_{10}H_8$ (**II**) are small and negative (heat absorbed $\not>$700 g.-cal. per mol.). The v.p. of (**I**) from 120° to 182° is given, and also some vals. of v.p. and vapour composition for mixtures of (**I**) and (**II**). Vals. of ρ, γ, and η for (**I**)–(**II**) mixtures are given. The deviation of the mol. vol. from additivity is small and positive. The curves of γ and η against composition are convex to the composition axis, but the deviations from linearity are not great. The departure of the f.p. curve from ideality is discussed in the light of these results. It is shown that the partial pressure of each component in the mixtures is always $>$ that calc. from its mol. fraction, and it is concluded that this deviation from Raoult's law, although not accompanied by marked abnormality of other properties, is responsible for the non-ideality of the f.p. curve. F. J. G.

Thermal, microscopic, and *X*-ray study of the system $NaPO_3$–$Na_4P_2O_7$. E. P. Partridge, V. Hicks, and G. W. Smith (*J. Amer. Chem. Soc.*, 1941, **63**, 454—466).—Mixtures of $NaPO_3$ and $Na_4P_2O_7$ have been investigated by heating and cooling curves, by high-temp. microscopy, by examination of cryst. solid phases by the polarising microscope, and by *X*-ray methods. $NaPO_3$ may be obtained in three cryst. forms and $Na_4P_2O_7$ probably in five with reversible transformations. Only one polyphosphate is reported, the tripolyphosphate, $Na_5P_3O_{10}$, which exists in two cryst. forms. W. R. A.

Thermal analysis of the systems $AlCl_3$–NaCl and $AlCl_3$–KCl. U. I. Schvartzman (*Ber. Inst. Chem. Akad. Wiss. Ukrain.*, 1940, **7**, 3—11).—The first system gives the compound $AlCl_3$,NaCl, m.p. 152° (decomp.), and two eutectics at 152° and 108° (39 mol.-% of NaCl). The second system gives $AlCl_3$,KCl, m.p. 257° (decomp.), and two eutectics at 257° and 128° (33 mol.-% of KCl). No other compounds can be detected. J. J. B.

Equilibria in the stannous oxide–sodium hydroxide and stannous oxide–hydrochloric acid systems at 25°. Analysis of dilute solutions of stannous tin. A. B. Garrett and R. E. Heiks (*J. Amer. Chem. Soc.*, 1941, **63**, 562—567).—The solubilities of SnO in NaOH, HCl, and H_2O have been determined and equilibrium consts., solubility product, heats of formation, and free energies of SnO and $Sn(OH)_2$, and heat of hydration of SnO have been calc. Polarographic and potentiometric methods of estimating Sn have been developed. W. R. A.

Equilibrium $Cd + SnBr_2 \rightleftharpoons Sn + CdBr_2$ in $AlBr_3$–KBr as solvent. J. K. Delimarski and K. S. Miroschnitschenko (*Ber. Inst. Chem. Acad. Wiss. Ukrain.*, 1940, **7**, 39—48).—Mixtures of KBr, $AlBr_3$, Cd, Sn, $CdBr_2$, and $SnBr_2$ were heated, and the mol. fraction x of Cd in the metal phase was determined. The equilibrium const. $x(1 - y)/y(1 - x)$, y being the mol. fraction of $CdBr_2$ in the salt phase, is almost independent of y; it is 0·005 and 0·009 at 360° and 460°, respectively. J. J. B.

Structure and properties of glasses from the point of view of the phase rule. K. G. Kumanin (*Bull. Acad. Sci. U.R.R.S., Sér. phys.*, 1940, **4**, 588—594).—By infinitely slow cooling a liquid glass would pass through several stable phases. The phase which would have separated first determines many properties of the solid glass such as its *X*-ray pattern, rate of crystallisation, etc. The curve showing the change of viscosity of liquid glass with composition changes its direction when the composition leaves the field of one and enters the field of another phase. J. J. B.

Methodics of the third law of thermodynamics. V. A. Plotnikov (*Ber. Inst. Chem. Akad. Wiss. Ukrain.*, 1940, **7**, 23—38).—Planck's assumption that the entropy at abs. zero = 0 is fundamentally different from Nernst's assumption that its change = 0. For the purpose of calculation both hypotheses are equiv. J. J. B.

Heats of dissolution of complex compounds of aluminium bromide and potassium chloride in benzene and toluene. S. I. Jakubson (*Ber. Inst. Chem. Akad. Wiss. Ukrain.*, 1940, **7**, 13—16).—From the measured heat of the decomp. of $2AlBr_3$,KCl in C_6H_6 or PhMe by H_2O the heat of dissolution is calc.; it is 5·6 kg.-cal. in C_6H_6 and 3·2 kg.-cal. in PhMe. The results make it probable that when KCl dissolves in a hydrocarbon solution of $AlBr_3$ no exchange of halogen takes place. J. J. B.

Thermochemistry of complex compounds of aluminium. III. Heat of formation of the complexes of aluminium bromide and ammonium halides. S. I. Jakubson (*Ber. Inst. Chem. Akad. Wiss. Ukrain.*, 1940, **7**, 17—22).—From the measured heat of dissolution the following heats of formation of the complex from the salts were calc.: $AlBr_3,NH_4Cl$ 16·59, $2AlBr_3,NH_4Cl$ 17·36, $AlBr_3,NH_4Br$ 13·45, $2AlBr_3,NH_4Br$ 15·62, $3AlBr_3,NH_4Br$ 16·15, $AlBr_3,NH_4I$ 11·82, and $2AlBr_3,NH_4I$ 12·24 kg.-cal. Comparison of these vals. with the decomp. potentials of the complex salts in C_6H_6 and EtBr shows that no halogen exchange takes place between $AlBr_3$ and NH_4Cl, but AlI_3 is formed from $AlBr_3$ and NH_4I. J. J. B.

Thermochemistry of non-aqueous solutions. I. Heat of dissolution of the bromides and chlorides of aluminium and antimony in nitrobenzene. V. A. Plotnikov and R. G. Vaisberg (*Ber. Inst. Chem. Akad. Wiss. Ukrain.*, 1940, **7**, 71—84). —The heat of dissolution in 100 mols. of $PhNO_2$, measured directly, was for 0·8—1 mol. of $AlCl_3$ 12·2, for 0·47—0·91 mols. of $AlBr_3$ 24·45, and for 0·77—1·17 mol. of $SbCl_3$ 0·7 kg.-cal. per mol. When 1 mol. of $SbCl_3$ is dissolved in 240 mols. of $PhNO_2$ containing 1·07 mol. of $AlBr_3$ 9·6 kg.-cal. are evolved; evidently a chemical reaction takes place. The heat of dissolution per mol. of $SbBr_3$ is max. (−1·14 kg.-cal.) when 1·7 mol. are dissolved in 100 mols. of $PhNO_2$; at 0·3 mol. it is −0·46. J. J. B.

VII.—ELECTROCHEMISTRY.

Crystal conductivity and relaxation conductivity of amorphous bodies. P. P. Kobeko (*Bull. Acad. Sci. U.R.S.S., Sér. phys.*, 1940, **4**, 604—606).—The equation $\log \rho = A + B/T$ between the electric resistivity ρ and temp. T is valid for both cryst. and vitreous forms of LiOAc, Seignette salt, and borax. The vals. of B are almost equal for both forms. At the upper boundary of the vitreous state the equation ceases to be correct, and the relation between ρ and T assumes the form peculiar to liquids. J. J. B.

Electrolysis of salts through a crystal membrane. V. A. Plotnikov, E. M. Skobetz, and G. A. Kleibs (*Ber. Inst. Chem. Akad. Wiss. Ukrain.*, 1940, **7**, 49—56).—15—20% $AgNO_3$ solutions in two crucibles were connected by a bridge of 50% of AgBr + 50% of AgI at 150°, and electrolysed. Ag was deposited on the cathode in the theoretical amount; Ag peroxide and O_2 were formed at the anode. The bridge was gradually destroyed, starting from the immersed ends. J. J. B.

Standard electrode potential of sodium. E. R. Smith and J. K. Taylor (*J. Res. Nat. Bur. Stand.*, 1940, **25**, 731—746).—From e.m.f. measurements on the cells Na (*s*)|NaI in $NHMe_2$| Na (0·0651% in Hg) and Na (0·0651% in Hg)|NaCl (0·05 or 0·1M.), AgCl|Ag, the standard electrode potential of the $Na(s)|Na^{\cdot}$ electrode at 5—40° has been determined as $E° = 2·71324 + 0·0007532(\theta - 25) + 0·000000688(\theta - 25)^2$. Vals. of the free energy, entropy, and heat content changes accompanying the reactions corresponding with various combinations of the cells are calc. J. W. S.

Electrolysis and galvanic concentration cells in the system bromine–pyridine. V. A. Plotnikov and V. I. Michailovskaja (*Ber. Inst. Chem. Akad. Wiss. Ukrain.*, 1940, **7**, 85—90).—3 to 4% C_5H_5N solutions in Br were electrolysed between Pt electrodes. 2 mols. of C_5H_5N per faraday are transported from the anode to the cathode compartment. Concn. cells made with Pt electrodes in 0·7—10% C_5H_5N in Br gave up to 0·017 v.; the electrode in the more dil. solution was positive. J. J. B.

Crystallisation electricity. A. Tschermak-Seysenegg (*Z. Krist.*, 1939, **101**, 230—258; cf. A., 1931, 1239).—Supersaturated solutions or supercooled melts of $NaOAc,3H_2O$, $KOAc,nH_2O$, $Na_2S_2O_3,5H_2O$, $KAl(SO_4)_2,12H_2O$, $NH_4Cr(SO_4)_2,12H_2O$, and salol are stable for indefinite periods in the absence of nuclei with crystal structures similar to those of the solid compounds. A crystallisation front which moves steadily through the liquid is initiated by cooling a point on the wall of the containing vessel with EtCl or solid CO_2. An apparatus is described in which currents produced during passage of the crystallisation front between two electrodes are registered by a capillary electrometer and recorded photographically. Various types of electrode are studied, in some of which intermediate solutions and porous diaphragms are used in order to avoid insertion of the electrode in the crystallisation path. The results are illustrated by numerous typical records, and explained in terms of charged zones in the neighbourhood of the crystallisation front. Loss of energy by radiation is not detected during crystallisation. A. J. E. W.

Redox titrations of vat dye systems.—See B., 1941, II, 76.

VIII.—REACTIONS.

Mechanism of dissolution of aluminium in aqueous or dry phenol. S. I. Volfson, P. F. Michalev, and I. D. Zacharotschkin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 32—35).—The rate of dissolution of Al in PhOH is decreased by a factor of 13 by the addition of 0·5 vol.-% H_2O. Further addition of H_2O does not affect the rate of dissolution. The rate of dissolution at 160° is < at 183°. the b.p. of dry PhOH, but not sufficiently for the effect of H_2O to be ascribed to the lowering of the b.p. of PhOH. The rate of corrosion is not increased when O_2 is blown through the liquid. It is supposed that the dissolution of Al in PhOH occurs by an electrochemical mechanism, Al ions dissolving from anodic and H_2 being evolved from cathodic sections of the metal surface. In presence of H_2O, mol. $Al(OH)_3$ would form at the anodic points and protect them from further action. O. D. S.

Velocity of rapid chlorination. H. C. Thomas (*J. Amer. Chem. Soc.*, 1941, **63**, 629—630).—The rate of chlorination of *p*-$C_6H_4Cl{\cdot}OH$ and the rate of the exchange reaction between Cl_2 and HCl* in C_6H_6 have been studied simultaneously. The velocity of the exchange reaction is $\gg$ the velocity of chlorination. W. R. A.

Kinetics and mechanism of the coupling of diazonium salts with aromatic amines in buffer solutions.—See A., 1941, II, 130.

Activation energies of some rate-limiting components of respiratory systems.—See A., 1941, III, 386.

Conditions governing steady burning of explosives.—See B., 1941, I, 192.

Reactivity of phenols towards paraformaldehyde. M. M. Sprung (*J. Amer. Chem. Soc.*, 1941, **63**, 334—343).—Kinetics of the addition and condensation reactions of 10 phenols and paraformaldehyde at 98° in the absence of H_2O and catalysed by $N(C_2H_4{\cdot}OH)_3$ have been studied. The additive reaction is apparently of first order and the rate coeffs. decrease in the following manner *m*-5-xylenol > *m*-cresol > 2 : 3 : 5-$C_6H_2Me_3{\cdot}OH$ > PhOH > *o*-4-xylenol > *p*-xylenol > *p*-cresol > saligenin (**I**) > *o*-cresol > *m*-2-xylenol. *m*-2-Xylenol reacted with only 0·5 mol. CH_2O and the main reaction product is 4 : 4′-dihydroxy-3 : 5 : 3′ : 5′-tetramethyldiphenylmethane. The reaction rates of (**I**) and of *o*- and *p*-cresol are approx. the same and suggest that the reactivity of PhOH is depressed to approx. the same extent by a $CH_2{\cdot}OH$ or CH_3 group substituted in the *o*-position. The effects of variation in the PhOH–paraformaldehyde ratio, catalyst concn. and temp. are discussed. The observed velocity coeffs. are composites of the rates of addition of the first, second, and third mols. of CH_2O. For saligenin the second mol. is added at approx. one third the rate of the first. An examination procedure has been developed to measure the speed of condensation reaction involving the conversion of $CH_2{\cdot}OH$ into CH_2 groups. The condensation rates of reaction are > the addition rates, but are in the same relative order, excepting for saligenin which condenses at a rate approx. equal to that of PhOH. A method is given for estimating the average chain length of the reaction products from the bromination and CH_2O addition data. The heat of activation of the addition reaction is 10,000 g.-cal. per mol., and 15,000 g.-cal. per mol. for the condensation reaction. W. R. A.

Catalytic action of natural mineral waters. G. Cronheim (*J. Physical Chem.*, 1941, **45**, 328—340).—The catalytic decomp. of H_2O_2 by $Fe^{\cdot\cdot}$ in mineral waters is discussed. OH′ and OH are formed by the oxidation of $Fe^{\cdot\cdot}$ and OH institutes a chain reaction in which OH′ and $H^{\cdot}$ are formed in equal amounts. Depending on the composition of the mineral water, OH′ and $H^{\cdot}$ are taken up in different amounts by secondary reactions, and the p_H alters. Decomp. of H_2O_2 is increased by all constituents which tend to bind $H^{\cdot}$, *e.g.*, H carbonates which react with $H^{\cdot}$ to form CO_2 and H_2O, whereby OH′ which normally neutralises the $H^{\cdot}$ is set free and the p_H rises. On the contrary decomp. is reduced by OH′-binding constituents, *e.g.*, $Ca^{\cdot\cdot}$. Secondary reactions are able to explain why the rate of decomp. is not const. and why it depends on the initial $[H_2O_2]$. C. R. H.

Reduction of silver ions by quinol and *p*-phenylenediamine in alkaline solution. T. H. James (*J. Physical Chem.*, 1941, **45**, 223—233).—The rate of reduction, R, of $Ag^{\cdot}$ by quinol in alkaline solutions of $Na_2SO_3 \propto [Ag^{\cdot}]^{0·5}$ at high $[Na_2SO_3]$ and low R. As R increases and $[Na_2SO_3]$ decreases the dependence of R on $Ag^{\cdot}$ increases as $[Ag^{\cdot}]$ increases, and if all factors except $[Na_2SO_3]$ are kept const. the dependence of R on $Ag^{\cdot}$ increases as $[Ag^{\cdot}]$ decreases. The data suggest the presence of quinone catalysis and experiments with duroquinol confirm this. In the reduction of $Ag^{\cdot}$ by *p*-$C_6H_4(NH_2)_2$ (**I**), $R \propto [Ag^{\cdot}]$ and $\propto 1/[Na_2SO_3]^2$. Adsorption of (**I**) occurs and the reaction is between this and free $Ag^{\cdot}$. A strong positive neutral salt effect is observed in this reaction and also when *p*-$NH_2{\cdot}C_6H_4{\cdot}OH$, *p*-$NMe_2{\cdot}C_6H_4{\cdot}OH$, and $(NH_2)_2C_6H_3{\cdot}SO_3H$ are the reducing agents. The explanation of these salt effects possibly lies in an increase in (**I**) adsorption. No effect or a small negative salt effect is observed when NH_2OH or *o*- or *p*-$C_6H_4(OH)_2$ is the reducing agent. C. R. H.

Acid-catalysed esterification of normal fatty acids. H. A. Smith and C. H. Reichardt (*J. Amer. Chem. Soc.*, 1941, **63**, 605—608; cf. A., 1939, I, 206).—The acid-catalysed esterification of 0·1N-AcOH, $EtCO_2H$, $Pr^{a}CO_2H$, $Bu^{a}CO_2H$, *n*-hexoic and lauric acid in MeOH at 20°, 30°, 40°, and 50° has been studied and the results are compared with existing data (cf. A., 1939, I, 327). The const., *r*, in Goldschmidt's equation is independent of the nature of the org. acid or its concn., and the activation energy is const. at $\sim$10,000 g.-cal. per mol. in agreement with the val. obtained with 0·5N. solution. W. R. A.

Lactase of *Escherichia coli*.—See A., 1941, III, 388.

Measurement of fast reactions by absorption spectrophotometry and its application to respiratory enzyme kinetics. F. Karush (*J. Opt. Soc. Amer.*, 1941, **31**, 73—76).—The instrument described by Harrison and Bentley (A., 1941, I, 89) is used to record graphically changes in optical density of solutions by comparison with the solvent at the rate of 20 comparisons per sec. Solutions are mixed in the absorption cell in $<$0·04 sec. by an injection device. The oxidation of guaiacol by H_2O_2 catalysed by horseradish peroxidase was followed by measurements of the absorption of the tetraguaiacol formed at 4750 A. An induction period of the order of tenths of a sec. is found. L. J. J.

Catalysis by ascorbic acid. G. G. Rao and T. V. S. Rao (*Current Sci.*, 1941, **10**, 24—25).—Ascorbic acid (**I**), but not $Na_2S_2O_3$, reduces AgCl. For a given concn. of (**I**) increasing amounts of $Na_2S_2O_3$ cause increased reduction and vice versa. Dehydroascorbic acid reduces AgCl only in presence of $Na_2S_2O_3$, indicating that AgCl is responsible for the oxidation of (**I**) and $Na_2S_2O_3$ for its re-formation. J. L. D.

Polymerisation of unsaturated hydrocarbons. I. Acid-catalysed polymerisation of *iso*butylene. II. Comparison of phosphorus pentoxide and orthophosphoric acid as a polymerisation catalyst. H. Shingu and N. Mutuda (*J. Soc. Chem. Ind. Japan*, 1940, **43**, 446—447B, 447—448B).—I. H_2SO_4 and H_3PO_4 catalyse the polymerisation of $CMe_2{:}CH_2$, the activity of the former increasing rapidly with increase in acid concn., whereas the activity of H_3PO_4 is less dependent on concn. With pumice impregnated with H_3PO_4 polymerisation increases with rise in temp. to a max. val. at 110—130° depending on the rate of flow of $CMe_2{:}CH_2$ vapour over the catalyst.

II. The activity of P_2O_5 is similar to that of H_3PO_4 except that max. polymerisation occurs at 60—70° and that less dimeride and trimeride and more higher polymerides are formed than with H_3PO_4. C. R. H.

Activation and poisoning of copper hydrogenation catalysts. B. B. Corson and V. N. Ipatieff (*J. Physical Chem.*, 1941, **45**, 431—440).—Data are recorded for the activation of Cu by Ni and Co and for the poisoning of the same catalyst by Bi, Cd, Pb, Hg, Sn, NaCl, and Na_2SO_4 in the hydrogenation of C_6H_6. At concns. $<$0·1%, Pb, however, acts as a promoter. Al_2O_3–Ni catalysts are only slightly active. Cu catalysts containing 5 and 10% Co are pyrophoric. C. R. H.

Mixed copper hydrogenation catalysts. V. N. Ipatieff and B. B. Corson (*J. Physical Chem.*, 1941, **45**, 440—443).—Various metallic oxides are able to activate Cu for the hydrogenation of C_6H_6. The most efficient oxides in order of decreasing effectiveness are CeO_2, Al_2O_3, ThO_2, and Cr_2O_3. Max. activity is obtained with $\sim$5% of oxide, the efficiency decreasing gradually as the concn. is further increased. With MnO_2 and UO_3 the efficiency, after an initial rise to 5%, remains const. from 5 to 80% of oxide. The efficiency of ZnO and Fe_2O_3 similarly increases rapidly to 5% but further increase in concn. brings about a gradual rise in efficiency to a max. val. at $\sim$70% of oxide. C. R. H.

Catalysis by activated copper sulphide. A. Wassermann (*Nature*, 1941, **147**, 391).—MeCHO (60 g.) and CuS (30 g.), activated by surface oxidation to $CuSO_4$, sealed in Pyrex glass and kept at 15—20° for 24 days yield paraldehyde (60% conversion). L. S. T.

Kinetics of dehydrogenation of *sec.*-butyl alcohol and reversible poisoning of copper catalysts. A. A. Balandin and A. L. Liberman (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 794—799).—The irreversible poisoning of Cu catalysts by *sec.*-BuOH is not due to any unsaturated alcohol present as impurity. The variation of reaction velocity with rate of passage of vapour and with temp. has been investigated. In the first case, the rate of evolution of H_2, $k' = (mM)/(M - 2m)$, where M is no. of mols. of vapour of reactant introduced into catalyst tube in unit time, and m is no. of mols. of vapour of reaction products leaving the tube in unit time. The heat of activation of *sec.*-BuOH is 8·6 kg.-cal. per mol. whereas the val. for primary alcohols is 12·8 kg.-cal. per mol. A. J. M.

Isomerising action of cyclising catalysts. J. Turkevich and H. H. Young, jun. (*J. Amer. Chem. Soc.*, 1941, **63**, 519—520).—The aromatising and isomerising properties of cyclising catalysts with $\beta\beta\delta$-trimethylpentane (**I**) and n-C_7H_{16} (**II**) at 475° have been investigated. CrO_3, CrO_3 on Al_2O_3, Al_2O_3 on CrO_3, and V_2O_3 on Al_2O_3 do not aromatise (**I**), indicating no isomerisation, whilst with (**II**) considerable quantities of aromatics are obtained, the olefine content of products from (**I**) being $>$ from (**II**). Mo_2O_3 on Al_2O_3 forms small but definite quantities of aromatic compounds from (**I**), indicating isomerisation, whilst considerable aromatisation of (**II**) occurs, the amount of olefine products from (**I**) and (**II**) being the same. W. R. A.

Catalytic toxicity and chemical structure. VII. Elimination of catalyst poisons by conversion into derivatives of shielded type. E. B. Maxted and R. W. D. Morrish (*J.C.S.*, 1941, 132—136).—S compounds in which the S atom has unshared electrons are catalyst poisons, but those in which the S atom is electronically saturated are not. Accordingly it should be possible to eliminate poisoning by converting the poison *in situ* into such a shielded compound. This has been realised experimentally. The toxic effect of Et_2S on a Pt hydrogenation catalyst is completely removed by addition of NaOCl, which converts it into non-toxic sulphone. Further the toxic effect of thiophen, the H_4-derivative of which gives rise to a sulphone, is much reduced by treatment with NaOCl after preliminary hydrogenation. F. J. G.

Effect of various catalysts on conversion of quartz into cristobalite and tridymite at high temperatures.—See B., 1941, I, 177.

Indium plating.—See B., 1941, I, 185.

Reduction of cystine at the dropping mercury electrode. I. M. Kolthoff and C. Barnum (*J. Amer. Chem. Soc.*, 1941, **63**, 520—526; cf. *ibid.*, 1940, **62**, 3061).—Cystine, RSSR, is determined polarographically at p_H 1, using thymol to suppress the max. The diffusion current $\propto$ the concn. Analysis of current–voltage curves show that reduction of RS·SR to cysteine, RSH, at the dropping Hg electrode does not occur reversibly according to $RS{\cdot}SR + 2H^+ + 2e \rightarrow 2RSH$, although the effect of p_H on potential is given approx. by the equation. For p_H 1—2 the reduction waves obtained with RS·SR in buffered solutions show a max. which is repressed by capillary-active substances. For p_H 3—9·2 two steps are found in the reduction waves. The first step is attributed to RSH formed by reduction reacting anodically with Hg to form HgSR, and the second step represents the true reduction wave. Capillary-active substances, thymol, camphor, gelatin, PhOH, resorcinol, methylene-blue, and Me-red, markedly shift the curves to more negative potentials and depress max. This effect has not previously been observed in polarographic investigations. The effects of camphor and thymol at different concn. and p_H are considered and the observed shift is attributed to the inhibition effects of the capillary-active substances on the orientation or adsorption of RS·SR at the surface of the Hg drop. The potential of RS·SR–RSH solution is a typical "mixed potential". The calc. diffusion coeff. of RS·SR in 0·1N-HCl at 25° is $5{\cdot}3 \times 10^{-6}$ sq. cm. per sec. W. R. A.

Photographic latent image.—See B., 1941, II, 170.

IX.—METHODS OF PREPARATION.

Water; some interpretations more or less recent. G. S. Forbes (*J. Chem. Educ.*, 1941, **18**, 18—24).—Recent views on the conditions of formation, the structure, and the co-ordination of H_2O, and the hydration of ions in solution are discussed. L. S. T.

Basic copper arsenate.—See B., 1941, III, 94.

Hydrothermal and *X*-ray studies of the garnet–hydrogarnet series and the relationship of the series to hydration products of Portland cement. E. P. Flint, H. F. McMurdie, and L. S. Wells (*J. Res. Nat. Bur. Stand.*, 1941, **26**, 13—33).—Treatment of CaO–Al_2O_3–Fe_2O_3–SiO_2 glasses (0—9% SiO_2) with H_2O at 175—250° yields solid solutions of the isometric forms of $3CaO,Al_2O_3,6H_2O$ (**I**) and $3CaO,Fe_2O_3,6H_2O$ (**II**). These solid solutions are also produced by the slow addition of dil. acidified solutions of $FeCl_3 + AlCl_3$ to a large vol. of boiling aq. $Ca(OH)_2$. The products tend to be contaminated with SiO_2 taken up from the glass or porcelain reaction vessel. The decomp. temp. of the solid solutions is the higher the lower is the Fe_2O_3 content. Addition of aq. $FeCl_3$ to aq. $Ca(OH)_2$ at room temp. yields the *compound*, $3CaO,Fe_2O_3,CaCl_2,10H_2O$, which when kept in contact with the mother-liquor slowly yields (**II**). Glasses containing 27—40% of SiO_2 yield solid solutions of (**I**) and (**II**) with $3CaO,Al_2O_3,3SiO_2$ (**III**) and $3CaO,Fe_2O_3,3SiO_2$ (**IV**). Attempts to replace CaO by MgO, MnO, BaO, or SrO, and Al_2O_3 or Fe_2O_3 by Cr_2O_3, in these products were unsuccessful. Treatment of $4CaO,Al_2O_3,Fe_2O_3$ with excess of H_2O yields mainly (**I**), but with a smaller quantity of H_2O the solid product contains some (**II**) in solid solution. The hydration products of the glass phase in Portland cement clinker belong to this series. *X*-Ray study shows that (**I**), (**II**), (**III**), and (**IV**) are all cubic and in the space-group O_h^{10}, with 8 mols. in the unit cell. J. W. S.

Corrosion of metals by non-aqueous solutions. Action of ethyl alcohol on metals. L. G. Gindin, R. S. Ambarzumian, and E. P. Beltschikova (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 44—47).—Al, Zn, and steel (C 0·28%, Mn 0·51%, Si 0·22%) are uncorroded when kept in sealed tubes in presence of air under abs. EtOH for 210 days, or under 99·7% EtOH for 150 days. Under the same conditions Mg undergoes slight focal corrosion. O. D. S.

Corrosion of metals by non-aqueous solutions. R. S. Ambarzumian, L. G. Gindin, and E. P. Beltschikova (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 91—94; cf. preceding abstract).—Mg is corroded by solutions of dry CO_2 in EtOH, H_2 being evolved and a white ppt. formed. The action is mainly confined to corrosion centres, the no. of which increases with time. Al and steel are unaffected by the solution. F. L. U.

Preparation of ammonium hydroxide for laboratory use. K. A. Kobe and T. S. Markov (*J. Chem. Educ.*, 1941, **18**, 29—30).—15·5—17N. aq. NH_3 is prepared from liquid NH_3. L. S. T.

SO as an intermediate product of the oxidation of hydrogen sulphide. N. M. Emanuel, D. S. Pavlov, and N. N. Semenov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 618—620).—In the oxidation of H_2S a slow reaction occurs accompanied by a decrease of pressure and giving relatively stable intermediate products which disappear according to the unimol. law. The absorption spectra of H_2S–O_2 mixtures at various times $\not> 3$ min. show bands attributed to SO. W. R. A.

Non-exchange of cobalt in certain complex salts. J. F. Flagg (*J. Amer. Chem. Soc.*, 1941, **63**, 557—559).—Exchange reactions between aq. Co^*SO_4 and $[Co(NH_3)_6](NO_3)_3$, $[CoCl(NH_3)_5]Cl_2$, $[Co(pn)_2Cl_2]Cl$, $[Co(NH_3)_3(NO_2)_3]$, $[CoCl(NO_2)_2(NH_3)_3]$, and $K_3Co(CN)_6$ indicate that the exchange $Co^{*\cdot\cdot} \rightleftharpoons Co^{\cdot\cdot\cdot}$ does not occur probably because $Co^{\cdot\cdot\cdot}$ ions are reduced by H_2O more rapidly than by exchange. W. R. A.

Oxidation processes in platinum oxalates. V. I. Goremikin and K. A. Gladischevskaja (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 625—628; cf. A., 1940, I, 267).—In the oxidation of Pt *trans*-H oxalates, the HC_2O_4 group is oxidised before the Pt, whereas with Pt *cis*-oxalates the Pt is first oxidised. *trans*-$[Pt(NH_3)(C_5H_5N)(HC_2O_4)_2],4H_2O$, and a red intermediate oxidation product, $[PtNH_3(C_5H_5N)Cl_3]$, have been isolated. The following have been produced and described: $[Pt(NH_3)_2(C_2O_4)Cl_2]$, $[Pt(C_5H_5N)_2(C_2O_4)Cl_2]$, and $[Pt(NH_3)(C_5H_5N)_2Cl_2]Cl$. W. R. A.

X.—ANALYSIS.

Physical basis for spectrographic analysis. W. F. Meggers (*J. Opt. Soc. Amer.*, 1941, **31**, 39—46).—A discussion of line strength and persistence in at. emission spectra. Electric arcs are the best exciting sources for first spectra. The strongest lines are invariably those involving *s–p* transitions. Unusual spectral sensitivity is found with elements containing a single *s* electron in the normal state. If the normal state contains 2 *s* electrons, the strongest line may involve a metastable configuration with 1 *s* electron. Where only *p* electrons are available, spectral sensitivity is low. A table of strongest lines of first spectra and the electronic states concerned is given for all the elements. L. J. J.

Accuracy in chemical analysis. Review of some analytical fundamentals. L. F. Taylor (*Ind. Chem.*, 1941, **17**, 59—62, 94—95).—Weighing, glassware, Pt ware, reagents, distilled H_2O, volumetric analysis, factors, and the determination of SiO_2 by way of example, are among the subjects discussed. L. S. T.

Polarography. W. C. Davies (*Ind. Chem.*, 1941, **17**, 98—102).—The principle of the method and the apparatus used are described. Examples of applications to qual. analysis, and to the determination of Cd in Zn blende, gases dissolved in H_2O, and oxidation products in Et_2O, are given. L. S. T.

Determination of exchangeable bases by the Lundegårdh spectrographic method. V. R. Ells and C. E. Marshall (*Proc. Soil Sci. Soc. Amer.* [1939], 1940, **4**, 131—135).—Methods of evaluating concns. of cations from the line intensities are compared. Good agreement between the two microphotometric methods and the approx. visual method with quintuplicate samples was obtained. With a recording microphotometer either the reciprocal (L/H) or the difference ($L - H$) of the line transparencies may be used to compare unknown concns. with standards. Details of the accuracy with different metals are given. S. and F. (*m*)

Spectrophotometric study of universal indicators. J. T. Woods and M. G. Mellon (*J. Physical Chem.*, 1941, **45**, 313—321).—Spectral transmission curves for solutions of 15 mixtures of indicators and of proprietary universal indicators have been determined over the range 400—700 mμ. and over the effective p_H range. Methoxy-reds and certain phthaleins are suggested as useful ingredients especially if a filter photometer can be employed. C. R. H.

Determination of halogen in mineral oils.—See B., 1941, I, 167.

Determination of iodine in livestock mineral mixtures.—See B., 1941, III, 130.

Improvement in mixing starch solution.—See B., 1941, III, 122.

Fluorescence analysis. VII. Rhodamine B and fluorescein as fluorescence indicators in oxidimetric titrations. VIII. Spectroscopic study of fluorescence tests. H. Goto (*Sci. Rep. Tôhoku*, 1940, **29**, 446—460, 461—466).—VII. The use of rhodamine B as indicator in iodometry, bromometry, and permanganometry and of fluorescein in bromometry has been investigated. The range of acidity and of indicator concn. over which they may be used is specified. Accurate results were obtained in solutions coloured by $Cr^{\cdot\cdot\cdot}$ ions.

VIII. The fluorescence spectra of the compounds the use of which was previously suggested (A., 1941, I, 219) for the detection of metallic ions have been photographed and are reproduced. O. D. S.

Determination of oxygen in tank hydrogen.—See B., 1941, I, 173.

Determination of sulphur in mineral oils.—See B., 1941, I, 167.

Determination of sulphides in depilatories.—See B., 1941, III, 110.

Determination of sulphur dioxide in beer and wine.—See B., 1941, III, 100.

Standardisation of sulphuric acid. W. H. King (*J. Assoc. Off. Agric. Chem.*, 1940, **23**, 542—543).—Standardisation of 0·1N-H_2SO_4 by means of $Na_2B_4O_7$ or by determination of *d* (Pickering–Marshall method) gives accurate results. F. O. H.

Co-precipitation with barium sulphate. M. L. Nichols and E. C. Smith (*J. Physical Chem.*, 1941, **45**, 411—421).—Co-pptn. of K salts with $BaSO_4$ decreases in the order NO_3', NO_2', ClO_3', Cl', MnO_4', Br', CN', I', $Fe(CN)_6''''$, $Fe(CN)_6'''$. Contamination is reduced by ageing the ppt. Adsorption on the surface of primary particles of $BaSO_4$ rather than solid solution formation in the interior of the $BaSO_4$ crystal is the principal factor in the co-pptn. of impurities. C. R. H.

Analytical chemistry of nitrogen compounds. II. Quantitative analysis of nitrous acid in alkaline solution. K. Suzuki (*J. Soc. Chem. Ind. Japan*, 1940, **43**, 440—441B).—To a solution containing ~30 g. of HNO_2 is added a reducing solution containing Na_2CO_3 28, glucose 1·2, $FeSO_4$ 20 g. The NH_3 formed is distilled and titrated. The influence of KNO_3, acid clay, and kieselguhr has been investigated. C. R. H.

Determination of nitrogen in steel and alloys.—See B., 1941, I, 183.

Volumetric micro-determination of arsenic. C. C. Cassil (*J. Assoc. Off. Agric. Chem.*, 1941, **24**, 196—202).—The previously described method (A., 1939, I, 534), applicable to 5—500 μg. of As_2O_3, has been modified to be applicable to 10 mg. with an error of ~1%. F. O. H.

Micro-determination of boron by means of quinalizarin and a photoelectric colorimeter. L. C. Olson and E. E. DeTurk (*Soil Sci.*, 1940, **50**, 257—264).—To the B solution (containing $\not>$0·03 mg. in 5 c.c.) is added 98·5% H_2SO_4. After cooling to 26·7° quinalizarin in 98·5% H_2SO_4 is added. The intensity of the blue colour is either compared with standards or determined by means of a photelometer. Blank determinations are essential. 0·0002 mg. of B per c.c. can thus be determined. A. G. P.

Determination of silicon in alloys.—See B., 1941, I, 183.

Determination of silica in acid-insoluble silicates. G. McClellan (*J. Assoc. Off. Agric. Chem.*, 1941, **24**, 111—113).—The sample (0·5 g.) is heated with Na_2CO_3 (6 g.) to ~1000°, the melt dissolved in HNO_3 (15 ml.; $HNO_3 : H_2O = 3 : 1$) and then treated with NH_4Cl (5 g.), $HClO_4$ (20 ml.), and H_2SO_4 (10 ml.). After boiling for 15 min., the mixture is diluted with 150 ml. of H_2O and filtered, the residue being washed, ignited, and weighed as crude SiO_2. Treatment with HF gives the wt. of SiO_2. F. O. H.

Determination of silica in calcined alumina.—See B., 1941, I, 173.

Semi-micro-determination of carbon and hydrogen in coals.—See B., 1941, I, 163.

Fluorescence analysis. V. Detection [of metals]. H. Gotô (*Sci. Rep. Tôhoku*, 1940, **29**, 204—218, 287—303; cf. A., 1940, I, 418).—Fluorescence reactions of 35 cations with cochineal, 8-hydroxyquinoline, rhodamine B, and morin are described and the sensitivity of the tests determined. Some fluorescence reactions with fused salt beads and with CaO beads are also described. A. R. P.

Spectroscopic analysis of solutions by a modified Ramage flame emission method. R. L. Mitchell (*J.S.C.I.*, 1941, **60**, 94—98).—Working concns. for the determination of 15 cations are given and factors affecting their sensitivity discussed. The accuracy of the method, which uses the burner designed by Steward and Harrison (cf. A., 1939, III, 799), is compared with that of the Lundegårdh method; approx. equal accuracy is obtained from quadruplicate determinations by the former and duplicates by the latter method. The use of the ratio rather than the difference of measurements of line and background densities in photometric evaluation is shown to be preferable.

Determination of sodium in aluminium.—See B., 1941, I, 186.

Determination of sodium.—See A., 1941, III, 407.

Flow sheet and material balance of a quantitative experiment. M. Randall and L. E. Young (*J. Chem. Educ.*, 1941, **18**, 32—34).—Flow sheets for the pptn. of AgCl and for the Jones reductor and titration with aq. $KMnO_4$ are reproduced and discussed. L. S. T.

Determination of magnesium and manganese in fertilisers.—See B., 1941, III, 90.

Determination of zinc in magnesium alloys and nickel alloys.—See B., 1941, I, 186.

Rapid determination of zinc in water.—See B., 1941, III, 136.

Detection of cadmium. F. A. van Atta and W. L. Wasley (*J. Chem. Educ.*, 1941, **18**, 31—32).—2 ml. of the ammoniacal solution containing $[Cu(NH_3)_4]^{\cdot\cdot}$ and $[Cd(NH_3)_4]^{\cdot\cdot}$ are evaporated to dryness. The residue is mixed with an equal vol. of Na_2CO_3 (1 part) and powdered C (1 part), and the mixture heated in an ignition tube to dull redness. Cd distils, and is deposited as a grey metallic mirror on the cool parts of the tube. Cu and Bi do not distil at this temp. The Cd mirror is rendered more visible by adding S to the tube and heating again when the orange form of CdS is formed. L. S. T.

Polarographic determination of indium and cadmium. S. I. Sinjakova (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 376—379).—In can be determined polarographically with a Hg drop cathode in 0·1N-KCl, -NaCl, -$LiNO_3$, -$ZnCl_2$, or -NH_4OAc, with [In] down to <0·001 mg. per ml. $Cu^{\cdot\cdot}$, $Fe^{\cdot\cdot\cdot}$, and $Pb^{\cdot\cdot}$ in very small concns. do not interfere. If $Cd^{\cdot\cdot}$ is present, it is determined separately in N-NH_3, 0·02N-NH_4Cl, a drop of 1% agar, and a crystal of Na_2SO_3 being added. $In^{\cdot\cdot\cdot}$ and $Cd^{\cdot\cdot}$ are then determined together in KCl solution. L. J. J.

Analysis of alloys by means of *X*-rays.—See B., 1941, I, 185.

Determination of copper in soils.—See B., 1941, III, 114.

Determination of mercury in food.—See B., 1941, III, 104.

Gravimetric determination of manganese with 8-hydroxyquinoline. K. Neelakantam (*Current Sci.*, 1941, **10**, 21—22).—The heat-stability of Mn 8-hydroxyquinolinate (**I**) depends on the method of pptn. If (**I**) is pptd. from neutral or weakly acid solution containing NaOAc and a small amount of sulphite or NH_2OH by 8-hydroxyquinoline (**II**) in EtOH it is decomposed at >110°. If (**I**) is pptd. from a mineral acid solution containing excess of (**II**) in AcOH by dil. aq. NH_3, it is stable to temp. of 150—170°. The influence of large amounts of NH_4Cl, NaCl, and $(NH_4)_2C_2O_4$ on the pptn. of (**I**) is briefly discussed and a method of determining Mg and Mn in rock analysis is outlined. W. R. A.

Standard solutions. R. L. Vandaveer (*J. Assoc. Off. Agric. Chem.*, 1940, **23**, 540—542).—The A.O.A.C. method of preparing standard aq. $KMnO_4$ affords a stable solution. Slight modifications in the official method of standardising acid solutions by means of $Na_2B_4O_7$ are recommended. F. O. H.

Standardisation of potassium permanganate solutions. G. M. Johnson (*J. Assoc. Off. Agric. Chem.*, 1940, **23**, 543—546).—0·1N-$KMnO_4$, prepared from unboiled H_2O without filtration and acidified with 0·5% of H_2SO_4, loses 16·3% of its strength in 133 days when kept in the dark. Solutions <0·1N. are prepared by diluting more conc. solutions with H_2O that has been distilled from alkaline $KMnO_4$, avoiding contamination by org. matter. Standardisation by $Na_2C_2O_4$, a temp. of 75—85° being maintained throughout the titration, is recommended. F. O. H.

Rapid determination of manganese in feeds.—See B., 1941, III, 105.

Colorimetric determination of iron with sodium salicylate. R. O. Scott (*Analyst*, 1941, **66**, 142—148).—A modification of the method described by Snell (" Colorimetric Methods of Analysis," Vol. I, p. 301) has been developed. Optimum conditions, and the errors resulting from variations in conditions and the presence of interfering ions, have been investigated. Under the conditions given, the total Fe is determined since $Fe^{\cdot\cdot}$ and $Fe^{\cdot\cdot\cdot}$ give the same colour intensity. In solutions of pure Fe the results are reproducible to 1%. The method can be used for soils and clays, and for concentrates and ppts. for spectrographic purposes; it is particularly useful when only 5—10 mg. of material, containing 2—20% Fe_2O_3, are available. Interfering ions $\not>$ Ti 0·3, Al 3·5, Mn 12·0, SiO_2 3·0, PO_4''' 4·0, F′ 0·1, and Cl_2 2·0 mg., all per 50 ml. of final solution, can be present. In general, interference from these substances will not occur. In the semi-macro-method described four determinations can be made in 2 hr. L. S. T.

Assay of iron in medicinal syrups.—See B., 1941, III, 131.

Volumetric determination of iron and aluminium in cement with 8-hydroxyquinoline.—See B., 1941, I, 179.

Complex ions. I. Spectrophotometric identification of complex ions in solution. W. C. Vosburgh and G. R. Cooper (*J. Amer. Chem. Soc.*, 1941, **63**, 437—442).—The formation of complex ions from a metallic ion *A* and either a mol. or an anion *B* according to $A + nB = AB_n$ has been studied by the method of Job (A., 1928, 589) for the formation of Cr_2O_7'' ions, the reactions between $Ni^{\cdot\cdot}$ ions and *o*-phenanthroline (**I**) and $(CH_2{\cdot}NH_2)_2$ (**II**), and the reactions between $Cu^{\cdot\cdot}$ and NH_3. If only one compound is formed the absorption of light is independent of λ but if > one compound is formed the λ of light used is important. (I) and (II) combine with $Ni^{\cdot\cdot}$ in ratios 3 : 1, 2 : 1, and 1 : 1; $Cu^{\cdot\cdot}$ ions and NH_3 combine in the ratios 1 : 2 and 1 : 4. W. R. A.

Radioactive determination of small amounts of uranium. W. D. Urry (*Amer. J. Sci.*, 1941, **239**, 191—203).—The determination of small amounts of U ($\sim n$ parts in 10^7) by means of indirect radioactivity measurements can be used only when radioactive equilibrium is known to be established. A direct method for determining such small amounts of U is now described. ^{238}U, ^{235}U, and ^{234}U are separated from other radio-elements by the use of $Ce^{\cdot\cdot\cdot\cdot}$, $Bi^{\cdot\cdot\cdot}$, $Pb^{\cdot\cdot}$, and $Ba^{\cdot\cdot}$ as co-precipitants for the latter. The Fe_2O_3 and Al_2O_3 in the sample itself are used as carriers in the final pptn. of the U with Fe_2O_3,nH_2O and Al_2O_3,nH_2O by means of aq. NH_3. The ignited ppt. is ground and suspended in EtOH. Thin layers are prepared, and the rate of emission of the α-particles from the U is recorded photographically. A correction for U in the reagents must be determined and applied to the results. Test data for the U in dunite, granite, and kimberlite show that the method is satisfactory. New data for the cores of three ocean bottom sediments obtained from the Cayman Trough between Cuba and Jamaica give U contents of 0·65—1·07 μg. per g. L. S. T.

Determination of small quantities of uranium by fluorescence method. V. Unkovskaja (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 380—383).—Small quantities of U, ranging from $\sim 5 \times 10^{-9}$ g. to 1 μg., are determined by fusion with NaF and visual comparison of the fluorescence produced by ultra-violet illumination with that of NaF containing known amounts of U. Data are recorded for U contents of natural petroleum ash samples, H_2O from petroleum-bearing beds, and marine deposits. L. J. J.

Application of iodate method to separation and determination of rare elements. T. A. Uspenskaja and J. A. Tschernichov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 800—801).—Zr salts react with KIO_3 to give sparingly sol. $2Zr(IO_3)_4,KIO_3,8H_2O$, which can be used in the volumetric determination of Zr. Ta can be extracted quantitatively as an iodate from its oxalate complex. The exact composition of the ppt. is not known, but an empirical factor has been obtained for determining Ta volumetrically by this method. Nb is not pptd. with KIO_3 under the conditions used for pptg. Ta. A. J. M.

Spectrochemical assay of gold ores.—See B., 1941, I, 185.

XI.—APPARATUS ETC.

Calibration of Debye–Scherrer *X*-ray powder cameras. A. J. C. Wilson and H. Lipson (*Proc. Physical Soc.*, 1941, **53**, 245—250).—Since vals. of *c* for quartz by Bradley and Jay (cf. A., 1933, 891) based on Bergqvist's vals. of *a* are inconsistent with *c* determined directly by Elg (cf. A., 1937, I, 436), *a* and *c* were determined in terms of the λ scale by two methods with Debye–Scherrer cameras. Results, $a = 4{\cdot}9032$ and $c = 5{\cdot}3937$A. at 18°, agree closely with Elg's val. of *c* and the Bradley–Jay val. of c/a, but indicate that Bergqvists' *a* is low by ~ 1 part in 20,000. A table of angles of reflexion is given for the revised vals. for adoption when quartz is used to calibrate a camera. N. M. B.

Immersion method [for measurement of refractive index of solids]. T. Carpanese (*Z. Krist.*, 1939, **101**, 284—289).—A mixed immersion medium containing a non-volatile liquid of high *n* (CH_2I_2 or 1-$C_{10}H_7Br$) and a volatile liquid of low *n* ($CHCl_3$, C_6H_6, CCl_4, or Et_2O) is employed. The specimen is placed in a glass cell with a plane-parallel bottom of high *n* and covered with the first liquid; the second liquid is added until the *n* of the mixture is slightly < that of the specimen. The mixture is allowed to evaporate until the *n* are equal; the cell is then covered and the *n* of the liquid determined with a total-reflexion refractometer through the bottom of the cell. A. J. E. W.

Projection comparator–densitometer. H. W. Dietert and J. Schuch (*J. Opt. Soc. Amer.*, 1941, **31**, 54—57).—The sample and master spectrograms are projected side by side on a translucent screen, and transmission vals. for individual lines are obtained by means of a slit system in contact with the plate, and a vac. photo-cell. L. J. J.

Photo-electric measurement of the average intensity of fluctuating light sources. J. S. Preston (*J. Sci. Instr.*, 1941, **18**, 57—59).—An arrangement for using a smoothing condenser in conjunction with a resistance coupled amplifier and an emission type photo-cell to give accurate averaging for the measurement of the mean intensity of periodically fluctuating light sources is described. A method is given for calculating the capacity necessary in any given case. A. J. M.

Photo-electric turbidimeter. S. Silverman (*Rev. Sci. Instr.*, 1941, **12**, 77—78).—The image of a grid, comprising alternate bars and open spaces, the bars and spaces being equal in size, is focussed on another identical grid, which is so adjusted that no light passes through. When a turbid liquid is introduced between the grids, light is scattered and passes through the second grid, its intensity being measured by means of a photo-cell immediately behind the second grid. The instrument is intended primarily for use with very clear liquids and is suitable for counting micellar organisms in aq. solutions, intensity measurements on fluorescent solutions, or for white blood or bacterial counts. J. W. S.

Microphotometer for spectrochemical analysis. E. M. Thorndike (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 66—67).—Apparatus and its operation and performance are described. L. S. T.

Concave grating photo-electric spectrophotometer. C. Sheard and M. N. States (*J. Opt. Soc. Amer.*, 1941, **31**, 64—69).—In the instrument described, monochromatic light of any desired λ is obtained from an incandescent or bright-line source by means of a concave grating and slit system, and used in conjunction with a barrier-layer photo-cell giving linear response. L. J. J.

Specifications and testing of spectrochemical apparatus. R. A. Sawyer and H. B. Vincent (*J. Opt. Soc. Amer.*, 1941, **31**, 47—53).—Design and testing of optical and photographic equipment for accurate emission and absorption spectrography in industrial conditions are discussed. L. J. J.

Focussing the spectrograph. D. E. Alburger (*Rev. Sci. Instr.*, 1941, **12**, 154).—A frame, movable only at right-angles to the spectral lines, and carrying a razor blade in the plane of the emulsion, is substituted for the back and plateholder. By placing the eye close to the focal plane immediately in front of a spectral line and moving the knife edge in from either side, the prism face is darkened evenly only if the line is in focus. A. A. E.

Multi-coloured wax light filter and dissecting chamber holder for microscopes. E. D. Crabb (*Rev. Sci. Instr.*, 1941, **12**, 154).—Pellets of Flexowax C, coloured with oil-sol. Glycolor dyes, are compressed in groups between a watch-glass and a glass slip. A. A. E.

Wedge-type p_H colorimeter. A. A. Hirsch (*J. Chem. Educ.*, 1941, **18**, 7—9).—The colorimeter is constructed from upright and inverted Erlenmeyer flasks placed in juxtaposition, and is an adaptation of the Bjerrum wedge system. L. S. T.

Ultramicroscope cell. V. Heines (*J. Chem. Educ.*, 1941, **18**, 28).—A cell constructed from a discarded motor tyre is described. L. S. T.

Photometric procedure using barrier-layer photo-cells. L. E. Barbrow (*J. Res. Nat. Bur. Stand.*, 1940, **25**, 703—710).—The procedure comprises the determination of the illumination–response curve of the cell used and a correction, by means of filters, to yield a spectral response curve simulating the International Committee luminosity curve. To avoid errors due to cell fatigue, readings are always made after such time that the current is a max. The method has been applied to determination of the relative intensities of light sources of various colours and of the transmission factors of coloured filters. J. W. S.

Simplified correction factor for equi-inclination Weissenberg patterns. B. E. Warren and I. Fankuchen (*Rev. Sci. Instr.*, 1941, **12**, 90—91).—The correction for the Lorentz polarisation–rotation factor for equi-inclination Weissenberg patterns is derived in terms of the Lorentz polarisation factor for the corresponding equator spot. J. W. S.

Simple and rapid method of adjusting the position of electrode pencils in routine spectrochemical analysis. H. R. Clayton (*J. Sci. Instr.*, 1941, **18**, 65).—Modifications to a Gramont arc and spark stand, designed to give more accurate and rapid adjustment of the position of the electrodes, are described. A. J. M.

Integrating photo-electric meter. J. B. H. Kuper, F. S. Brackett, and M. Eicher (*Rev. Sci. Instr.*, 1941, **12**, 87—90).—A robust meter, which operates from a.c. mains and is unaffected by weather conditions, is described. It employs a photo-cell with a very pure Ti cathode of threshold $\sim$3160 A. A condenser and cold cathode " trigger " tube are sealed in an extension of the glass envelope to eliminate moisture. The small current pulse through the trigger tube is amplified and recorded in a telephone. Curves are given for the erythemal radiation received on clear days over periods of 18 months. The spectral response curves of modern Ta and Ti photocells are also given. J. W. S.

Optical method for measurement of ultrasonic absorption. E. C. Gregg, jun. (*Rev. Sci. Instr.*, 1941, **12**, 149—151).—The voltage applied to a vibrating crystal in liquids to bring the convergence points of parallel light into focus in a microscope at various distances down the beam is measured. Absorption coeffs. (Biquard's α_B) at 1901·5 kc. are: C_6H_6 (22°) 0·032, PhMe (22·5°) 0·0099, $CHCl_3$ (16°) 0·051. A. A. E.

Electron multiplier as an electron counting device. Z. Bay (*Rev. Sci. Instr.*, 1941, **12**, 127—133).—The construction of electron multipliers is discussed. A 12-stage multiplier using Ag–Mg electrodes gave a total multiplication of 10^8 for an overall voltage of 3500 v.; thermal emission was negligible and field emission absent. Application to the counting of photons, α- and β-particles, and γ- and *X*-rays is discussed. A. A. E.

Ionisation amplifier. H. Le Caine and J. H. Waghorne (*Canad. J. Res.*, 1941, **19**, **A**, 21—26).—By the motion of a reed, a charge on the electrode of an ionisation chamber is caused to change an a.c. potential, this change being amplified and used to measure the ionisation current by a condenser balance method. J. W. S.

Wilson chamber. Y. Monteux (*Ann. Acad. Brasil. Sci.*, 1940, **12**, 347—348).—A simplified apparatus is described. F. R. G.

Apparatus for the measurement of α-particle range and relative stopping power of gases. M. Y. Colby and T. N. Hatfield (*Rev. Sci. Instr.*, 1941, **12**, 62—66).—The apparatus operates on the principle of Naidu's apparatus (A., 1934, 235) for measuring the sp. ionisation with a thin chamber. The collecting electrode comprises a circular Al ring, 4 mm. wide and 22 cm. in diameter, the source being at the centre and the slit made of brass plates so shaped as to give a disc of collimated α-particles. The effective source–electrode distance can be varied by changing the gas pressure in the chamber. The apparatus has been used to measure the relative stopping powers of several gases and the additivity law has been verified for all gases measured, including N_2O (cf. Schmieder, A., 1939, I, 441). J. W. S.

" Magic eye " ionisation gauge. L. N. Ridenour (*Rev. Sci. Instr.*, 1941, **12**, 134—136).—The plate microammeter is replaced by a 6*E*5 tube, which contains a fluorescent screen on which electron bombardment produces a pattern. The grid current in the gauge tube is controlled at a const. val. A. A. E.

Regulated battery-operated high voltage supply. J. G. Barry (*Rev. Sci. Instr.*, 1941, **12**, 136—139).—The circuit described can furnish $\not<$100 μa. at $\not>$2000 v. It is suitable for making accurate Geiger counter measurements, and for use with portable Ra finders and radioactivity meters. A. A. E.

Light weight high voltage supply for Geiger counters. H. V. Neher and W. H. Pickering (*Rev. Sci. Instr.*, 1941, **12**, 140—142).—The instrument (650 g.) gives an output potential of $\not>$2000 v.; the power consumption is 0·3—0·5 w., and the power output suffices for 6 counters at 3000 each per min. The output voltage may be stabilised at $\pm$20 v. with Ne lamps. A. A. E.

Use of the Geiger–Müller counter for small quantities of liquids. H. A. C. McKay (*Rev. Sci. Instr.*, 1941, **12**, 103—104).—The liquid is contained in a small stoppered glass cylinder, closed at the base with a thin Cellophane window, of diameter slightly > that of the window of the counter. The assembly of a small counter (natural effect $\sim$5 counts per min.) suitable for this purpose is described. J. W. S.

Electron microscope. A. L. G. Rees (*Chem. and Ind.*, 1941, 335—337).—A review of general principles and technique, illustrated by typical photomicrograms. A. J. E. W.

Vacuum-tight sliding seal. R. R. Wilson (*Rev. Sci. Instr.*, 1941, **12**, 91—93).—A cylindrical bar or tube slides through a thin piece of sheet rubber in which a hole is cut of diameter $\ll$ that of the bar. The bend in the rubber produced thereby is maintained towards the high-pressure side by a conically-shaped seating through which the bar passes. Suitable gasket dimensions for sealing various sizes of rods are tabulated. The seal permits unlimited translational or rotational motion of the rod. J. W. S.

Interferometric dilatometer with photographic recording. F. C. Nix and D. MacNair (*Rev. Sci. Instr.*, 1941, **12**, 66—70).—Three pieces of the material under investigation rest between two optically polished fused SiO_2 discs, and dimensional changes are observed by photographing the interference fringes at frequent intervals. A portion of the lower SiO_2 plate is formed into a wedge, the interference fringes from which serve to indicate temp. changes. Arrangements of the apparatus suitable for use at −195° to 700° are described. Its use is illustrated by measurements of the expansion of quartz in a direction perpendicular to the optical axis. J. W. S.

Abbreviation of the method of least squares. G. J. Cox and (Miss) M. C. Matuschak (*J. Physical Chem.*, 1941, **45**, 362—369).—Mathematical. C. R. H.

Theory of the separation of isotopes by thermal or centrifugal methods. A. Bramley (*Science*, 1940, **92**, 427—428). L. S. T.

Thermal balance. E. Orosco (*Publ. Inst. Nac. Tecn., Rio de Janeiro*, 1940, 31 pp.).—Apparatus is described for the automatic recording of the rate of reactions which involve a change in wt. due to the liberation or absorption of a gaseous phase, exemplified by data for the dehydration of gypsum; $BaCl_2,2H_2O$; $CuSO_4,5H_2O$; magnesia alba; schist and bauxite; decomp. of $CaCO_3$ and roasting of coffee (cf. B., 1936, 714). F. R. G.

Rapid method of correcting for inequality of beam arms in the analytical balance. J. C. Williams (*J. Chem. Educ.*, 1941, **18**, 38).—The correction curve for loads of 10-, 20-, and 50-g. wts. on each pan is determined, and then the correction (mg.) is added to or subtracted from a given load to convert it into an abs. wt. L. S. T.

Precision of weighing with microchemical balances. (Miss) M. Corner and H. Hunter (*Analyst*, 1941, **66**, 149—154).—The performance of one microchemical balance has been examined in detail and the performances of 7 others in less detail. Precision in weighing, *i.e.*, reproducibility, has been found by repeated determinations of one nominal g. wt. against another. Six of the balances showed no certain difference in performance, but two of them, used by students, showed a precision one third of that of the others. The mean precision of a single weighing in routine work, measured by its probable error, is $\sim \pm 3$ μg. Most of this is due to error in placing the rider. The error introduced into an analytical result by weighing errors alone is not likely to exceed 1% more than once in a 10^3 analyses, but may exceed 0·5% once in $\sim$20 analyses, and will exceed 0·1% in 2 out of 3 analyses. These figures refer to a simple analysis in which the result is obtained as a quotient of 2 weighings by difference, and in which both sample and product weigh between 2 and 4 mg. The precision of the microchemical balance is only just sufficient for the purpose for which it is used, and it may be expected to introduce errors from weighing alone comparable with those introduced by the chemical manipulation. L. S. T.

XII.—LECTURE EXPERIMENTS AND HISTORICAL.

Lecture demonstrations. F. B. Dutton (*J. Chem. Educ.*, 1941, **18**, 15—17).—Apparatus for demonstrating Boyle's law and heat changes accompanying change of state is described and illustrated. L. S. T.

Bergman, Klaproth, Vauquelin, Wollaston. E. G. Ferguson (*J. Chem. Educ.*, 1941, **18**, 3—7). L. S. T.

XIII.—GEOCHEMISTRY.

Distribution of electricity in thunderclouds. (Sir) G. Simpson and G. D. Robinson (*Proc. Roy. Soc.*, 1941, **A**, **177**, 281—329).—Further observations were carried out in the years 1937—1939 on the electric field in eight thunderstorms. In every cloud there is a positive charge of electricity near the top where the temp. is $<-10°$. Below this there is a negative charge and generally in this region the temp. is $<0°$. These charges are generated by the collisions of ice crystals in the turbulent ascending air currents in the storm; the ice becomes negatively and the air positively charged. The charges are separated by the sinking of the ice crystals. Below the negative charge there is generally a region containing positive charges and in which the temp. is $>0°$. These lower positive charges are associated with heavy rain and are generated by the breaking of rain drops in ascending currents of air. G. D. P.

Evolution of the atmosphere. J. H. J. Poole (*Sci. Proc. Roy. Dublin Soc.*, 1941, **22**, 345—365).—An attempt to calculate the constitution of the atm. from the composition of rocks in the lithosphere and from the amount of igneous rock denuded during geological time indicates that the total free C now buried in sedimentary rock could not have been derived from the CO_2 in the primitive atm. The original liberation of free O_2 is attributed to photo-dissociation of H_2O vapour in the upper atm. at high temp., allowing enough O_2 to be accumulated to start plant life and then produce by the photo-synthetic decomp. of CO_2 the main bulk of atm. free O_2 or that used in the formation of sedimentary rocks. The problems involved are considered quantitatively and the accumulation is shown to accord with accepted views on the existence of terrestrial life. The absence of O_2 and H_2O vapour from the outer atm. of Venus is briefly discussed. N. M. B.

Lithium in the thermal waters of Kasakhstan. I. P. Novochatski and S. K. Kalinin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 53—54).—The Li content was determined spectroscopically using the 3232·67 A. line as standard. Dry residues from thermal waters from different thermae contain 0·005—0·1% Li. O. D. S.

Distribution of ozone in the stratosphere: measurements of 1939 and 1940. W. W. Coblentz and R. Stair (*J. Res. Nat. Bur. Stand.*, 1941, **26**, 161—174; cf. A., 1939, I, 391).—Further investigations have confirmed the results recorded previously. J. W. S.

Water of the Vretenice spring on the island of Krk. S. Miholić (*Arh. Kemiju*, 1940, **14**, 24—26).—The H_2O does not differ from that of other Dalmatian springs, except in its appreciable radioactivity. R. T.

Matijino spring at Ponijevo near Zepče, Bosnia. H. Iveković, L. Dančević, and M. Herrmann (*Arh. Kemiju*, 1940, **14**, 21—23).—The H_2O contained Na 0·3072, K 0·0517, Ca 0·3856, Mg 0·4127, Fe 0·0099, NH_4 0·0002, Cl′ 0·2140, SO_4'' 0·1979, HCO_3' 3·5427, NO_3' 0·00006, H_2SiO_3 0·1115, and CO_2 1·9830 g. per l., in Sept., 1939. R. T.

Palæochemistry of the ocean. E. J. Conway (*Nature*, 1941, **147**, 480).—The original K : Na ratio of the ocean, and oceanic salinity at the beginning of the Cambrian period, are discussed. L. S. T.

Lake deposits. B. M. Jenkin, C. H. Mortimer, and W. Pennington (*Nature*, 1941, **147**, 496—500).—The core-sampler and the sampling operation used in the investigation of the deposits of Lake Windermere, the composition of the cores and the org. remains in them, are described. L. S. T.

Geochemical calculations concerning the total mass of sediments in the earth. P. H. Kuenen (*Amer. J. Sci.*, 1941, **239**, 161—190; cf. A., 1938, I, 331).—The total amount of all sediments deduced previously is tested by Clark's Na_2O method, and corr. The new val. for the average speed of oceanic deposition is 1 cm. of solid material in 6×10^3 years. The total thickness of sediments, including pore-space, averages 3 km., and the vol., 13×10^8 km.^{3} The total amount derived from weathering is 8×10^3 km.^{3}, and is divided as follows: continental clay 1·2, sandstone 0·4, limestone 0·3, unweathered volcanic deposits, graywackes, etc. 0·1, red clay 4·4, blue mud 1·1, and Globigerina ooze 0·5, all $\times 10^8$ km.^{3} CaO has been stored up from the Cambrian to the Cretaceous, and is now being transferred to the deep sea, a process that will produce a CaO famine in $\sim 15 \times 10^7$ years. L. S. T.

Shallowater [Lubbock Co., Texas] meteorite: a new aubrite. W. F. Foshag (*Amer. Min.*, 1940, **25**, 779—786).—The meteorite consists of pure enstatite 81, fosterite 5, oligoclase ($Ab_{83}An_{17}$) 2, Fe–Ni ($Fe_{93}Ni_7$) 9, troilite 1·5 (**I**), and miscellaneous 1·5%. The silicates are unusually free from Fe. The meteoric material may be the result of crystallisation from a melt, and the Fe–Ni and (**I**) may be later introductions. L. S. T.

Hysteresis in feebly magnetic sedimentary rocks. A. G. Kalaschnikov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 368—371).—The magnetic susceptibility of a variety of sedimentary rocks has been measured by a torsion balance method, at field strengths (H) up to 1935 oersted. All paramagnetic samples showed a decrease in susceptibility with increasing H, and also remanence and coercivity vals., not correlated with the Fe oxide content. Diamagnetic samples showed decreasing susceptibility with decreasing H, and sometimes change of sign at low H. Vals. of H for saturation in the ferromagnetic components of the samples are 700—800 oersted. L. J. J.

Mineral resources of continental Europe. W. J. Arkell (*Nature*, 1941, **147**, 404—407, 443—446).—A summary concerned with minerals of strategic importance. L. S. T.

[Brazilian] kieselguhr (diatomite). S. Fróes Abreu (*Publ. Inst. Nac. Tecn., Rio de Janeiro*, 1939, 70 pp.).—A review of the distribution of kieselguhr in Brazil. Methods of purification, removal of sand, its use in filtration of oils, and its efficiency as a heat insulator are recorded. Vals. of d and composition are given for a no. of samples. F. R. G.

Mineralogy of the Negus and Con mines, Yellowknife, N.W. Territories, Canada. G. C. Ridland (*Econ. Geol.*, 1941, **36**, 45—70).—The ore in these Au mines contains much visible Au, and runs \$30—40 to the ton. The lode deposits consist of quartz–carbonate veinlets that follow zones of shearing in pre-Cambrian andesites. The mineralogy, which is described, is complex. Sulphides, arsenides, antimonides, tellurides, and many uncommon minerals, including gudmundite, FeSbS, are present. They indicate intermediate temp. deposition, whilst textures and structures suggest low-pressure deposition. The indicated depths of the deposits point to the future importance of the Yellowknife field as a mining district. L. S. T.

Occurrence of gudmundite. E. Sampson (*Econ. Geol.*, 1941, **36**, 175—184; cf. preceding abstract).—Gudmundite (**I**) is of more widespread occurrence than is generally recognised. Properties of (**I**) from different localities are summarised. (**I**) favours heavy sulphide deposits rich in Fe, and in these deposits belongs to a group of minor minerals later than the main sulphides. Pb sulphoantimonides and fahlerz accompany (**I**). Au vals. may be either high or negligible. L. S. T.

Crystal structure of gudmundite (FeSbS) and its bearing on the existence field of the arsenopyrite structural type. M. J. Buerger (*Z. Krist.*, 1939, **101**, 290—316; cf. A., 1937, I, 204, 289; 1938, I, 217; 1940, I, 240).—The structure is conveniently referred to a doubly-primitive ($B2_1/d$) cell containing 8 mols., with a' 10·00, b' 5·93, c' 6·73 A., β 90° 0′. At. parameters and interdistances, determined by trial and error calculation of intensities, are tabulated. The results confirm that the at. radii in the arsenopyrite group are incompatible with vals. obtained from pyrite group structures; the deviations are examined in detail with reference to the mode of packing, and qual. adjustments of the arsenopyrite parameters are proposed. The field of existence of the arsenopyrite structure and its relation to the cobaltite structure are discussed; the former is favoured for the compound $AB'B''$ if the at. radius ratios $r_A/r_{B'}$ and $r_{B'}/r_{B''}$ are small. A. J. E. W.

Optical, spectrographic, and radioactivity studies of zircon. J. H. Morgan and M. L. Auer (*Amer. J. Sci.*, 1941, **239**, 305—311).—Data on the radioactivity, n, and Hf : Zr and Y : Zr ratios are tabulated for zircons (**I**) from the Lake Superior district. The malacon shows a radioactivity > that of the normal and hyacinth types, and, in general the hyacinth type > that of the normal. 24 samples of (**I**) showed (spectrographically) the presence of Zr, Si, Hf, Y, Ce, Pb, Fe, and Ti. Ge is present in 20 of the samples. No relationships between

Y content and radioactivity or between Y and Hf contents are apparent. The variations in physical properties of (**I**) may be due to breakdown of the crystal lattice by the action of radioactive elements included at the time of crystal formation, and the type of (**I**) present in a granite may be governed by the [U] in the magma at the time of formation of the crystals of (**I**). L. S. T.

Theory for the concentration and distribution of copper in the earth's crust. C. H. White (*Econ. Geol.*, 1941, **36**, 1—18).—Cu occurs in traces, at least, throughout the entire crust of the earth, but commercial deposits, although found in every type of rock, occur only where the crust has been fractured, fissured, or sheared. As the earth cooled to temp. at which combination of atoms took place, the interaction of physical and chemical forces, particularly gravity and the union of the elements in order of the heats of formation of their compounds, depressed the major parts of Cu, S, and other of the less chemically active heavy metals and their associated anions to a zone below the silicates where they remained until released by fractures in the solid crust. The order in which metals and anions tend to combine during a falling temp., the compositions of the more important hypogene sulphides, and the average chemical compositions of wall rocks and metamorphic minerals are tabulated. L. S. T.

Chalcocite problem. N. W. Buerger (*Econ. Geol.*, 1941, **36**, 19—44).—The solid phases of the system Cu_2S–CuS have been studied by means of a special camera designed to take *X*-ray photographs of powder samples at elevated temp. The phase diagram (reproduced) shows that the system contains 3 compounds, viz., chalcocite (**I**) (Cu_2S), digenite (**II**) (Cu_9S_5), and covellite (CuS), and 4 phases. The *X*-ray data and the time–temp. curve show that (**I**) undergoes transformation at 105°; above 105°, the hexagonal basic structure, and below 105°, the orthorhombic superstructure, is stable. No cubic high-temp. phase appears up to at least 300°. The superstructure phase can dissolve up to 8 at.-% CuS, and the basic structure up to 2 at.-%. Below ~78°, (**II**) has the composition Cu_9S_5, but above 78°, it takes increasing amounts of either Cu_2S or CuS into its composition. When (**I**) is heated in air it begins to be converted into (**II**); this may explain certain anomalous results obtained previously. L. S. T.

High radium content of a Brazilian mineral. J. Costa Ribeiro (*Ann. Acad. Brasil. Sci.*, 1940, **12**, 341—346).—Ore from Rio Branco and Conceição (Minas-Gerais) contains 232—273 mg. of Ra per m. ton. F. R. G.

Metamorphic strata of Carandaí (Minas-Gerais). O. H. Leonardos (*Ann. Acad. Brasil. Sci.*, 1940, **12**, 243—259).—Analyses of a silurian conglomerate formation from Carandaí and a no. of neighbouring strata are recorded and their bearing on the formation of the strata is discussed. F. R. G.

Kurnakovite, a new borate. M. N. Godlevski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 638—640).—The analysis and optical and thermal characteristics of *kurnakovite*, $2MgO,3B_2O_3,13H_2O$, are given. W. R. A.

Native iron of the Timan. I. A. Preobrashenski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 634—637).—Slicks from the N. Timan contain grains of Fe which, on spectroscopic analysis, show Mn and Si (lines > average), Cr, Al, and Ti (very weak), and Ni, Ca, and Cu (slight traces). W. R. A.

Magnetite in sulphide ores. (A) D. Gallagher. (B) J. S. Brown (*Econ. Geol.*, 1941, **36**, 95—100, 100).—(A) A comment on previous work (A., 1941, I, 62). Magnetite that appears to be later than the pyrite with which it is associated occurs in a Au-quartz vein of the Lupa Goldfield, Tanganyika.

(B) A correction (cf. A., 1941, I, 62). L. S. T.

Age of the continental deposits of the eastern slope of the South Urals. K. V. Nikiforova (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 323—324).—Evidence for Tertiary (neogene) rather than Jurassic origin of a no. of patches of Continental deposits is summarised. L. J. J.

Devonian and crystalline rocks in the western regions of the Bashkir A.S.S.R. V. A. Balaev (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 320—322).—Granites belonging to the base of the Central Russian platform, found at a depth of 1589 m. in the Tuymaza district, are described. The granites belong to the pre-Cambrian base of the platform. Marine sedimentary formations in the eastern Central Russian platform date from the second half of the Middle Devonian. The bearing of these observations on the distribution of oil-bearing deposits is indicated. L. J. J.

Titanovesuvianite from the Perovskite mine in the Chuvash mountains, South Urals. L. L. Schilin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 325—327).—Crystallographic data are given for a new variety of vesuvianite containing $\ngtr$4·59% TiO_2. L. J. J.

Alteration product of abukumalite. S. Hata (*Bull. Inst. Phys. Chem. Res. Japan*, 1941, **20**, 41—43).—Analyses of the weathered outer shell of abukumalite (**I**) from Iisaka, Fukushima Pref., and of the wholly disintegrated mineral indicate accumulation of ThO_2, Fe_2O_3, and Ce_2O_3 and diminution of CaO, MnO, and Y_2O_3 in the weathered product. (**I**) probably exists in Hagata pegmatite. W. R. A.

Rôle of fluorine in phosphate deposition. G. R. Mansfield (*Amer. J. Sci.*, 1940, **238**, 863—879).—F is an essential constituent of phosphate rock, and tends to keep it relatively insol.; F is suggested as the agent by which phosphate deposits have been preserved through successive geological ages. Volcanism, as a source of F, may have been an indirect but determinative factor in the origin of the principal phosphate deposits of the U.S.A. L. S. T.

Fluorite and celestite in the Kungurian deposits of the Ural–Emba region. V. P. Baturin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 827—828).—The fluorite in these deposits is secondary in origin. Similarity with the composition of rocks of the Zamiatin salt-dome points to a secondary transference of F and Sr in this case too, resulting in a high concn. of these elements in the carbonates of this dome. A. J. M.

Re-definition of tellurobismuthite and vandiestite. C. Frondel (*Amer. J. Sci.*, 1940, **238**, 880—888).—Tellurobismuthite (**I**), Bi_2Te_3, is a distinct species and not a variety of tetradymite (**II**). (**I**) from Whitcharn, Colorado, has a_0 4·38, c_0 30·6, a_{rh} 10·51 A., and α 24° 2′. In (**I**) layers of Te atoms take the place of layers of S atoms in (**II**). Etch reactions for (**I**), (**II**), gruenlingite, and joseite are tabulated. Five new localities for (**I**) are recorded. *X*-Ray powder photographs and a new chemical analysis [F. A. Gonyer] show that vandiestite is a mixture of (**I**) and hessite. L. S. T.

Crystal structure of violarite. F. A. Bannister (*Min. Mag.*, 1941, **26**, 16—18).—Chemical analysis by Short and Shannon (A., 1930, 1551) showed that violarite has the formula $(Ni,Fe)_3S_4$ and is not, as Lindgren (1924) suggested, a mixture of pentlandite and NiS_2. This is confirmed by *X*-ray examination of material from Sudbury, Ontario, which showed a face-centred cubic (spinel) structure with edge 9·51 A. Material from Sudbury had previously been considered to be polydymite, but violarite differs from this in containing much Fe, in the absence of twinning, and in the violet colour on polished sections. Linnaeite from Müsen, Westphalia, and the original polydymite from Grüneau mine, Rhineland, both have the same type of structure, with *a* 9·40 and 9·47 A., respectively. L. J. S.

Optical properties of olivines from Ubekendt Island, west Greenland. P. M. Game (*Min. Mag.*, 1941, **26**, 11—15).—Measurements of *n* (β 1·666—1·690) and the optic axial angle (2*V* 87·5—89·75° ±) were made of olivines from a thick series of lavas and from dykes. The data indicate that in any one rock there may be a max. variation of 9 mol.-% Fe_2SiO_4. The relative merits of β and 2*V* as guides to the chemical composition are discussed. L. J. S.

Selenium and tellurium contents of sulphur from Krisuvik, Iceland. J. N. Friend and J. P. Allchin (*Min. Mag.*, 1941, **26**, 9—10).—The crude mineral (*a*), extracted S (by CS_2) (*b*), and insol. residue (*c*) contained Se, Te, and Ti, respectively: (*a*) 18·9, 378, 120; (*b*) 12·5, 250, —; (*c*) 200, 4000, 3750 p.p.m. Ni, Fe, Ca, and Ba are also present in (*c*). L. J. S.

Sulphatic cancrinite and analcime from Loch Borolan, Assynt. F. H. Stewart (*Min. Mag.*, 1941, **26**, 1—8).—Large cleavable masses of blue sulphatic cancrinite occur in pegmatite veins in borolanite. Analysis gave SiO_2 34·76, Al_2O_3 30·81, CaO 3·87, SrO 0·32, Na_2O 18·90, K_2O 1·29, CO_2 1·90, SO_3 5·93, H_2O+ 2·30, H_2O- 0·20, total 100·28; *d* 2·42,

ω 1·502, ϵ 1·497. The mineral is isomorphous with cancrinite with SO_3 replacing CO_2, and in the series the ordinary refractive index (ω) and the birefringence decrease with increase of SO_3. Analcime gave SiO_2 52·89, Al_2O_3 24·63, CaO 0·19, Na_2O 13·31, K_2O 0·73, H_2O+ 7·66, H_2O- 0·29, total 99·70; *d* 2·268, *n* 1·486—1·488. It shows optical anomalies and is compared with the eudnophite from Norway. L. J. S.

Felspars from Schwanberg (Styria). L. Dolar-Mantuani and S. Koritnig (*Z. Krist.*, 1939, **101**, 30—38).—Detailed optical data are given for felspars and plagioclase from a marble deposit penetrated by aplite; the felspars resemble those from the neighbouring Pohorje mountains. A Schwanberg felspar (*d* 2·557) contained SiO_2 63·60, Al_2O_3 19·68, CaO 1·62, Na_2O 2·82, K_2O 11·92, H_2O+ 0·40%, with traces of Fe_2O_3 and MgO, corresponding with the composition $Or_{70}Ab_{24}An_6$. A. J. E. W.

Liquid inclusions as the cause of imaginary pelitisation of felspars. D. S. Korshinski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 112—114).—Microscopical examination of a large no. of rock samples leads to the conclusion that in a large majority turbidity is due to small liquid inclusions. These inclusions may be evenly dispersed or may lie along concealed cracks; gas bubbles are absent. Turbidity in felspars is associated with incomplete change, in consequence of which defects in the crystal lattice are present; these then become filled with liquid. Similar liquid inclusions, often erroneously described as pelitic, occur in other minerals, especially in micas, carbonates, zeolites, quartz, prenite, and gypsum. F. L. U.

Spectrographic study of Central American and Asiatic jades. D. Norman and W. W. A. Johnson (*J. Opt. Soc. Amer.*, 1941, **31**, 85—86).—Specimens of jade from Maya objects and from Asiatic sources were analysed spectrographically in a C arc. The differences are wholly mineralogical, no major differences in composition being found. L. J. J.

***X*-Ray study of the carnallite–bromocarnallite mixed-crystal series.** K. R. Andress and O. Saffe (*Z. Krist.*, 1939, **101**, 451—460).—From oscillation *X*-radiograms, the tetragonal $KMg(H_2O)_6Cl_3$–$KMg(H_2O)_6Br_3$ mixed-crystals, in which Br forms 20·4—74·7 (p) at.-% of the total halogen, have *a* 13·302—13·519±0·004, *c* 6·685—6·775±0·002 A.; ρ 1·7030—2·0118±0·0005; 4 mols. in unit cell; space-group C_{4h}^3—*P*4/*n*. At. parameters are determined from space-filling and charge-distribution considerations, and by calcultion of intensities; the structure is closely related to that of perowskite. Statistical distribution of Cl and Br atoms is confirmed. The *a* and *c* vals. rise abruptly between $p = 45$ and 67, and with $p > \sim 67$ the *X*-radiograms indicate a higher degree of symmetry (apparent space-group D_{4h}^7—*P*4*nmm*). These anomalies are ascribed to a new type of isomorphism, in which changes in the hydratation energy relationships cause a rearrangement of the H_2O mol. orientations. $KMg(H_2O)_6Cl_3$ is rhombic-pseudohexagonal, with *a* 9·54, *b* 16·02, *c* 22·52 A.; ρ 1·602; 12 mols. in unit cell; space-group V_{2h}^4—*Pban*. $KMg(H_2O)_6Br_3$, $RbMg(H_2O)_6Cl_3$, and $NH_4Mg(H_2O)_6Cl_3$, respectively, are weakly monoclinic, with *a* 13·59, 13·30, 13·30; *b* 6·79, 6·65, 6·66; *c* 6·80, 6·62, 6·68 A.; ρ 2·134, 1·79, 1·46; 2 mols. per unit cell. A. J. E. W.

Crystal structure of valleriite. J. E. Hiller (*Z. Krist.*, 1939, **101**, 425—434).—An original specimen of valleriite (cf. Ramdohr and Ödman, *Geol. Fören. Stockholm Förh.*, 1922, No. 54) contains Cu 18·67, Fe 21·47, S 22·31, Al_2O_3 6·09, MgO 17·87, CaO 0·93, MnO 0·10, SiO_2 1·75, H_2O 12·16% [analysis by (Frl.) Bendig]. From powder *X*-radiograms, the rhombic-pseudohexagonal crystals have *a* 6·13, *b* 9·81, *c* 11·40 A.; ρ 3·09; 2 mols. in unit cell; space-group D_{2h}^5. Cleavage and optical data indicate a layer lattice. At. parameters are derived by analogy with MoS_2, and confirmed by calc. intensities; the min. interat. distances are Fe—Fe 2·26, Cu—Cu 2·72, Fe—S 2·19, Cu—S 2·43 A. The structural analysis is based on the formula $Cu_2Fe_4S_7$, but the proposed structure contains spaces which may be filled by Mg; the formula $Cu_2Fe_4S_7Mg(OH)_2$ gives a better *Z* val. (1·98) than $Cu_2Fe_4S_7$ (2·23). $Cu_3Fe_4S_7$ is unlikely as the at. radii correspond with Cu^{I} and Fe^{III}. A. J. E. W.

Structure of manganese leonite. H. Anspach (*Z. Krist.*, 1939, **101**, 39—77).—Schiebold oscillation photographs show that the doubly primitive monoclinic unit cell, containing four $K_2Mn(SO_4)_2,4H_2O$ (**I**) mols., has a_0 11·986, b_0 9·57, c_0 9·95 A., β (crystallographic) 85°; ρ 2·313; space-group C_{2h}^3. Complete at. parameters are reduced from Patterson and Fourier analyses giving projections on (001), (100), and (010). The arrangement of K, Mn, and S atoms resembles that in Tutton's salts (cf. A., 1935, 415, 1001) and alums, the Mn atoms forming a completely filled cubic face-centred lattice; a comparison of the structures of these salts shows increasing distortion of the octahedral disposition of M^{I} atoms around M^{II} (or M^{III}) with decreasing hydration, but the tetrahedral arrangement of M^{I} around the S atoms is maintained. The H_2O mols. of (**I**) form complex $[Mn(H_2O)_4]^{\cdot\cdot}$ ions which occur as rectangles perpendicular to the plane of symmetry. The proposed structure is in accord with Pauling's electroneutrality rule and with crystallographic data. A. J. E. W.

"Isomorphism" of monazite and crocoite. S. von Gliszczynski (*Z. Krist.*, 1939, **101**, 1—16).—Monazite is more closely related crystallographically to xenotime than to crocoite, with which it is isotypical but not truly isomorphous. Rotation photographs of a Perdatsch turnerite give a_0 6·782, b_0 6·993, c_0 6·455 A., β 76° 22·1′; 4 mols. per cell; ρ calc. 5·217: a crocoite from Beresowsk (Urals) has a_0 7·108, b_0 7·410, c_0 6·771 A., β 77° 33′; 4 mols. per cell; $\rho_{calc.}$ 6·107. Both minerals have the space-group C_{2h}^5, and a structural similarity is confirmed by powder *X*-radiograms; some specimens of monazite, however, give a different diagram showing a similarity to xenotime. This may be due to isomorphous mixtures of $CePO_4$ and YPO_4, but it is more probable that monazites of magmatic origin have had a deformed xenotime structure which has undergone slow and sometimes incomplete transformation into a structure of the turnerite type; turnerite, originally formed at lower temp., has retained its structure unchanged. Monazite may act as a "geological thermometer." A. J. E. W.

Magnetic studies on braunite, $3Mn_2O_3,MnSiO_3$. K. S. Krishnan and S. Banerjee (*Z. Krist.*, 1939, **101**, 507—511).—A specimen of braunite (Mn 54, Fe^{II} 1·2%) has $\chi = 145{\cdot}5$—$55{\cdot}2 \times 10^{-6}$ c.g.s. units at 301·8—668·1° K.; the Curie temp. is 76° K., the Curie const. 0·0327, and the effective magnetic moment 5·1 Bohr magnetons. If $\chi_{\perp}$ and $\chi_{\parallel}$ are the susceptibility vals. perpendicular and parallel to the tetragonal axis, $\chi_{\perp} - \chi_{\parallel} = 0{\cdot}364 \times 10^{-6}$ at 300·8° K.; more than half of this val. is attributed to Fe. The low anisotropy supports the constitution $3MnMnO_3,MnSiO_3$ for braunite. A. J. E. W.

Minerals of the descloizite group. Konichalcite, staszizite, austinite, duftite, aräoxene, volborthite, pyrobelonite. H. Strunz (*Z. Krist.*, 1939, **101**, 496—506).—Powder and rotation *X*-radiograms show that the following two groups of minerals form isodimorphous series which are related to each other by "internal twinning": (*a*) (monoclinic); tilasite, durangite, cryphiolite: (*b*) (rhombic); adelite, austinite, higginsite (a_0 5·84, b_0 9·21, c_0 7·42 A.; 4 mols. in unit cell; $\rho_{calc.}$ 4·294; $\rho_{obs.}$ 4·33) (konichalcite, staszizite), duftite, aräoxene, volborthite (calciovolborthite, tangeite), descloizite (dechenite, psittacinite, chileite, eusynchite), mottramite, pyrobelonite (a_0 6·22, b_0 9·57, c_0 7·56 A.). Brackebuschite has a different structure. Names of other varieties or structurally identical minerals are added in parentheses. A. J. E. W.

Chemical study of silicates. IX. Transformation of tremolite into diopside on heating. E. Thilo (*Z. Krist.*, 1939, **101**, 345—350).—Rotation photographs show that the transformation of tremolite into $MgSiO_3$–diopside mixed crystals and SiO_2 (cf. Posnjak and Bowen, A., 1931, 1146), at 1100°, occurs by the mechanism proposed previously for the anthophyllite–enstatite transformation (cf. A., 1939, I, 287). The Si–O chains in tremolite retain their direction in the resulting mixed crystals. The SiO_2 is formed as completely disordered particles of cristobalite. A. J. E. W.

Composition of jarosites from the deposits of Central Kazakhstan. F. V. Tschuchrov, R. E. Arest-Jakubovitsch, and H. A. Kozlova (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 829—831).—Jarosites have usually been formed by the weathering of pyrites, or from marcasite or pyrrhotite. Analyses of 10 samples are given, among which Na jarosites predominate. P, Al, and Ca are present in all samples, and Mg is absent, or occurs only in traces. Se occurs in certain samples, whilst spectroscopic traces of V, Ga, In, Mo, Sn, and Ag were detected. A. J. M.

Distribution of metal values in ore deposits. N. K. Razumovski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 814—816).—The arithmetic mean of ore samplings does not correctly characterise the deposit. A better val. is the geometric mean. The distribution of Au in a no. of samples is logarithmic, and the same law was found to apply to Cu, Pb, and Zn ores from a given deposit. A. J. M.

Chlorine and bromine in massive crystalline rocks. L. S. Selivanov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 809—813).—The mean Br content of 23 rocks was $1\cdot62 \times 10^{-4}\%$, and the Cl content $3\cdot14 \times 10^{-2}\%$. Various types of rocks differ very little in their Cl and Br content. The most acid and the most basic rocks contain somewhat less Br than the intermediate ones. The ratio Cl : Br varies considerably, the average being 243. This ratio is markedly lower for basic than for acidic rocks. Soils contain an average of $6\cdot51 \times 10^{-4}\%$ and peats $3\cdot1 \times 10^{-3}\%$ of Br, so that the Br content of soils is at least 4 times and of peats 20 times that of rocks. Almost all this Br in soils and peats is combined in org. compounds. The Cl content of soils is approx. the same as that of rocks. The ratio Cl : Br in sea-H_2O is $>$ that in rocks. This cannot be accounted for by weathering of rocks, and is probably due to the preponderance of Cl_2 and chlorides in volcanic gases, which become dissolved in the sea. A. J. M.

Possible type of cassiterite mineralisation in the near-polar Urals. S. G. Sarkisian (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 807—808).—Investigation of loose sedimentary deposits of certain rivers in the N. Urals shows the presence of scheelite, Au, and cassiterite. The last is accompanied by sulphides (pyrites, chalcopyrite, arsenopyrite), and is sometimes found as an intergrowth with sulphides. It may therefore be assumed that the formation of cassiterite-bearing loose deposits is connected with the decay of a primary Sn mineralisation of the sulphide type. A. J. M.

Isotopic composition of cuprite oxygen. W. H. Hall and C. Hochanadel (*J. Amer. Chem. Soc.*, 1940, **62**, 3259—3260).—Cuprite (**I**) was reduced by electrolytic H_2 and ρ of H_2O formed was compared with ρ of H_2O formed from H_2 and atm. O_2. Vals. of ρ were determined by a buoyancy balance method in which temp. was the observed variable. The H_2O from (**I**) had a flotation temp. $0\cdot021° <$ that of H_2O from O_2, indicating that the contribution of the O of (**I**) to the ρ of the H_2O formed is 5·5 p.p.m. $<$ that of atm. O_2. The isotopic composition of O of (**I**) is approx. the same as that of ordinary H_2O. W. R. A.

Alkaline province in the northern part of central Siberia. G. Moor (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 225—229).—Various rocks from this region are described and discussed. J. W. S.

Killough-Ardglass dyke swarm. S. I. Tomkeieff and C. E. Marshall (*Quart. J. Geol. Soc.*, 1940, **96**, 321—338).—Petrological. Chemical analyses of the lamprophyre and Tertiary dykes, and mineral analyses are recorded. L. S. T.

Borrowdale volcanic series of Coniston, Lancashire. G. H. Mitchell (*Quart. J. Geol. Soc.*, 1940, **96**, 301—319).—Stratigraphical. L. S. T.

Carboniferous limestone of the Castleton–Bradwell Area, North Derbyshire. J. Shirley and E. L. Horsfield (*Quart. J. Geol. Soc.*, 1940, **96**, 271—299). L. S. T.

Sodium bicarbonate (nahcolite) from Searles Lake, California. W. F. Foshag (*Amer. Min.*, 1940, **25**, 769—778).—$NaHCO_3$, occurring in monoclinic crystals and twins chiefly in a gaylussite marl, has been found in large amounts in a well core drilled below the central salt crust of Searles Lake. Its crystallography, physical and optical properties, and paragenesis are discussed. $NaHCO_3$ may have been formed by the interaction of trona and $Ca(HCO_3)_2$ solutions. L. S. T.

Lamprobolite, a new name for basaltic hornblende. A. F. Rogers (*Amer. Min.*, 1940, **25**, 826—828).—The amphibolite with high Fe^{III} content and high vals. of n, and called basaltic hornblende, basaltine, oxyhornblende, etc., is best named lamprobolite. L. S. T.

Effect of adsorbed substances—hardness (or strength) reducers—on the mechanical strength of quartz sediments in water. P. Rehbinder and J. B. Aron (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 802—806).—The adsorption of certain electrolytes by rock surfaces greatly reduces their hardness, and facilitates drilling. This phenomenon has been investigated by finding the mechanical strength of suspensions of the rock in H_2O, or a solution of an electrolyte, after compression around a screwed Al rod, by centrifuging. The max. stress necessary to tear the rod from the sediment was determined. There is a very marked decrease in the strength of the sediment when very small quantities of hardness reducers (NaCl, $MgCl_2$, $AlCl_3$) are added to the H_2O in which a pure quartz sediment is formed. The decrease is the more effective the greater is the valency of the cation. Sucrose also causes a decrease in strength. The theory is that adsorption decreases the cohesion between particles. The thickest liquid film between grains, and hence the greatest looseness of sediment, occurs when there is the smallest coagulation effect, and thus the process is related to peptisation. Further increase in the concn. of electrolyte leads to a decrease in the thickness of the adsorbed film, with consequent increase in strength. A. J. M.

Vanadium in oil products and bituminous rocks. G. G. Bergman (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 108—111).—Results of the analysis of a no. of oils, oil products, and associated rocks for V are recorded. The ash of one oil examined contained $>12\%$ V. F. L. U.

Quantitative *X*-ray study of soils. J. C. L. Favejee (*Z. Krist.*, 1939, **101**, 259—270).—A method of analysis of powders is outlined in which the relative proportions of the constituents are determined by comparison of their Debye–Scherrer line intensities with those given by mixtures of known composition; the intensities are not accurately $\propto$ the percentages of the constituents. The line intensities are estimated by direct reference to the intensity of the primary *X*-ray beam. The method is used to determine quartz, muscovite, kaolinite, and montmorillonite in the clay fractions of certain Dutch soils. Large deficits in the total clay content are obtained; these are ascribed to particle size effects, and show that the particle sizes in the specimen and reference mixture must be controlled within narrow limits. A. J. E. W.

Vanadium and nickel in coal from the upper Silurian strata of the Alai and Turkestan mountains. A. L. Vorobiev (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 250—251).—Shale samples from coal seams in the Alai and Turkestan mountains contain NiO 0·039—0·07% and V 0·03—0·12%. Ash from various samples of coal from these regions contains NiO 0·00—1·40% and V_2O_5 0·00—1·30%. J. W. S.

Mineral content of Bevier coal seam, Boone County, Missouri. T. R. Gallacher (*Mines Mag., Denver, Colorado*, 1940, **30**, 586—590, 611—612).—The minerals were deposited in a definite order as follows: syngenetic minerals (**I**) (marcasite and/or pyrite); pene-contemporaneous minerals (concretionary pyrite); epigenetic minerals (transparent scaly calcite, gypsum, transparent scaly calcite, pyrite, sphalerite, fibrous calcite). The (**I**) were doubtless controlled by the character of the original swamp solutions. The subsequent periods of mineralisation were related to solutions derived from over- or under-lying formations, to the chemical changes produced by interaction with minerals in the coal, or to mingling with O-bearing solutions. R. B. C.

Older and more recent [German] brown coals. W. Gothan (*Braunkohle*, 1941, **40**, 37—40).—Peat-bog formation occurred in the older Eocene brown coals even under tropical conditions and was not exceeded in intensity by that in the more recent (Lower Miocene) coals. Peat-bog formation occurred formerly and occurs at present in the tropics to a very small extent. The higher bitumen content of the older brown coals is probably due to the presence among tropical plants of more numerous sources of resin, wax, and oil than occur in temperate climates. It can be assumed that this was true formerly. The formation of coking coal was probably favoured by the heat of the tropical climate in the case of the older brown coals inasmuch as the oxidisable humic substances were more abundant and more easily decomposed than in the cooler Miocene climate. R. B. C.

INDEX OF AUTHORS' NAMES, A., I.

JUNE, 1941.

PRINTED IN GREAT BRITAIN BY RICHARD CLAY AND COMPANY, LTD., BUNGAY, SUFFOLK.