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

MAY, 1941.

I.—SUB-ATOMICS.

Rendering visible and photographing of the Hertzian-wave region. V. K. Arkadiev and D. I. Penner (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 315—317).—Radiation of λ of ∼1 cm. can be rendered visible or photographed by causing it to impinge on a photographic plate covered with a thin layer of Al, Cu, or Ni particles ∼1 mm. length. Shaking the plate causes sparking between the metallic particles, which produces a photographic trace. L. J. J.

Selective absorption of light in interstellar space. A. Hunter (*Physical Soc. Rep. Progr. Physics*, 1940, **7**, 150—159, and *Nature*, 1941, **147**, 152—153).—A progress report and a review. L. S. T.

Distribution of energy in the visible spectrum of daylight. A. H. Taylor and G. P. Kerr (*J. Opt. Soc. Amer.*, 1941, **31**, 3—8).—Spectral energy distribution between 4000 and 7000 A., and colour temp., are recorded for direct sunlight and a variety of different types of sky, near Cleveland, Ohio. L. J. J.

The corona spectrum, June 19, 1936, at Omsk. G. Schain (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 778—781).—A spectrophotometric investigation of the corona as observed at the eclipse on this date has been made. The intensity of emission lines varies within large limits, absolutely and relatively, when passing from one region of the corona to another, and from one eclipse to another, as shown by comparison with data obtained from the 1929 eclipse. There is no proportionality between intensity of emission lines and that of the continuous spectrum with increasing distance from the solar limb, and with changing brightness of different regions of the corona. This can be explained in terms of the ionisation theory. There is evidence that a single source controls the equilibrium and excitation in the chromosphere, the protuberances, and the inner corona. A. J. M.

Breadth of spectral lines at large densities of a homogeneous gas. V. Fursov and A. Vlassov (*J. Physics, U.S.S.R.*, 1939, **1**, 335—340).—The broadening of the resonance level caused by dipolar interaction between similar mols. in gases under pressure is calc. The results are not applicable to all spectral lines involving the resonance level, but to those which arise through transitions from upper levels to the resonance level, and to those corresponding with transition from a resonance to a metastable level. There is satisfactory agreement with experiment. A. J. M.

Theorem on nuclear motion in atomic spectra. J. P. Vinti (*Physical Rev.*, 1940, [ii], **58**, 882—883; cf. A., 1940, I, 49).—Mathematical. The theorem derived concerns the energy shift of an at. level due to nuclear motion, and is in a suitable form for calculating isotope shifts when the radial wave functions are known only as numerical vals. N. M. B.

Isotope shift in boron. J. P. Vinti (*Physical Rev.*, 1940, [ii], **58**, 879—881; 1941, [ii], **59**, 103).—(A) Shifts reported by Mrozowski (cf. A., 1939, I, 289) are calc. with the aid of Morse–Young–Haurwitz wave functions (cf. A., 1936, 133). Results are −0·3665 cm.⁻¹ for either member of λλ 2497, 2498 of B I and +0·566 cm.⁻¹ for λ 3451 of B II, and their comparison with experiment and other data is discussed. The estimated possible spread due to nuclear spin is ∼0·03 cm.⁻¹ in each case, explaining the absence of nuclear spin hyperfine structure in the spectrograms.
(B) A correction. N. M. B.

Pressure effects of homogeneous rubidium vapour on its resonance lines. C. S. Yi (*Physical Rev.*, 1940, [ii], **58**, 884—

887).—The broadening of the resonance lines of Rb in absorption up to 150 mm. pressure of its own homogeneous vapour was studied with a 21-ft. grating. For pressures <1 mm. the broadening was very symmetrical, but at high pressures it showed van der Waals-type asymmetry. The $^2P_{1/2}$ component showed red, and the $^2P_{3/2}$ component violet, asymmetry. Both lines showed the proportionality of the width to concn. of Rb atoms. The experimental width at half-max. is greater by a factor 1·5 than that predicted by Houston's theory (cf. A., 1939, I, 50), and the width of the transition from $^2P_{3/2}$ is greater by a factor 1·6 than that from $^2P_{1/2}$. A narrow diffuse band was observed near the shorter-λ side of the $^2P_{1/2}$ component and a similar one near the longer-λ side of the $^2P_{3/2}$ component. N. M. B.

Influence of extraneous elements on line intensity. III. Effect of anions. W. R. Brode and E. S. Hodge (*J. Opt. Soc. Amer.*, 1941, **31**, 58—63; cf. A., 1940, I, 329).—The effect of addition of a variety of anions, in the form of Ca or Ba salts, on the intensity of emission lines of Bi, Pb, Sb, Sn, Cd, and Zn oxides or carbonates mixed with $CaCO_3$ and excited by means of a C arc is recorded. Anions which tend to give subhalide band spectra show a greater effect in repressing line intensity than those which break down to CaO or BaO. The effect of CaF_2 is > that of $CaCl_2$. The effect generally increases with concn. of the test element, and in the case of CaF_2 approaches a max. with increasing [CaF_2]. In the absence of admixtures, for a series of salts with a common cation, the line intensity of the cation increases with the volatility of the salt or its decomp. products. L. J. J.

Hyperfine structure of ionised mercury lines. (A) L. Sibaiya. (B) S. Mrozowski (*Physical Rev.*, 1940, [ii], **58**, 925; 1941, [ii], **59**, 104).—(A) A comparison of the results of Mrozowski (cf. A., 1940, I, 138) with those independently obtained by Sibaiya.
(B) A discussion of the above. N. M. B.

New lines and terms in the arc and first spark spectra of molybdenum : Mo I and Mo II. (Miss) M. R. Schauls and R. A. Sawyer (*Physical Rev.*, 1940, [ii], **58**, 781—783).—The spectrum excited in a hollow-cathode discharge was photographed from 540 to 10,830 A. The resonance triplet of Mo II, $^6S-^6P^o$, was found, thus locating the lowest term, $^6S_{5/2}$, at 11,783·70 cm.⁻¹ below the previously known lowest level $^6D_{1/2}$. 20 new lines are classified, 7 new levels established, and 2 new multiplets, $^6D-^6P^o$ and $^6D-^6D^o$, arranged. 36 additional lines of Mo I are classified. N. M. B.

Interactions in the tungsten atom, W I, in a magnetic field. J. H. Roberson, J. E. Mack, and G. R. Harrison (*Physical Rev.*, 1940, [ii], **58**, 895—902).—General expressions are deduced for the magnetic field dependence of the energies and intensities of neighbouring levels (regardless of coupling) of an atom. The energy dependence is tested experimentally for the levels 21,448₂ and 21,453₁ of W I and vals. for consts. are found. Discrepancies between calc. and observed energies are attributed to slight repulsive forces from other levels and disturbances of reference lines. N. M. B.

Comparison of X-ray absorption fine-structure for two elements in the same crystal. S. T. Stephenson (*Physical Rev.*, 1940, [ii], **58**, 873—876).—The fine-structures on the short-λ side of the K X-ray absorption edges of Cu, Se, Br, Rb, Sr, and As in RbBr, $SrBr_2$, Cu_2Se, CuBr, ZnSe, AgBr, $CuSeO_4,5H_2O$, $CuHAsO_3$, and $Cu_3(AsO_4)_2,4H_2O$, investigated with a focussing transmission spectrograph, are not identical for two elements in the same ionic crystal lattice, and some

are different even at 150 v. energy distances from the main edge. The fine-structure is influenced by factors other than crystal structure alone.   N. M. B.

Measurement of the excitation potentials of the mercury atom by means of a photon counter. M. Djatschenko and V. Selegenev (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 19—21).—The excitation of Hg atoms by electrons of varying energy has been followed by means of a photon counter. The observed energy levels and ionisation potential agree with spectroscopic and photo-electric vals.   O. D. S.

Photo-electric spectrophotometry and its uses in industry. W. D. Wright (*Physical Soc. Rep. Progr. Physics*, 1940, **7**, 36—40).—A progress report.   W. J.

Photo-electric efficiency of iron, cobalt, and nickel at different temperatures in the soft X-ray region. K. S. S. Iyer (*Current Sci.*, 1940, **9**, 537—538).—Soft X-rays, freed from ions and electrons, were caused to strike a target (Fe, Ni, Co, or Cu) and the photo-electrons produced were attracted by an external shield maintained at 54 v. above the potential of the target. The photo-electric current was measured at temp. between 30° and 950°. The photo-electric sensitivity (ϕ) of Fe is const. up to ~780°, then decreases by ~10% between 780° and 900°, and thereafter increases. The Curie point of Fe is 770°±5° and the $\alpha \rightarrow \beta$ transition occurs at this temp. whilst the $\beta \rightarrow \alpha$ transition occurs at 910°. Co and Ni give const. vals. of ϕ throughout the whole temp. range, showing no variation at Curie or transition points.   W. R. A.

Photo-electric work functions of (100) and (111) faces of silver single crystals and their contact potential difference. H. E. Farnsworth and R. P. Winch (*Physical Rev.*, 1940, [ii], **58**, 812—819).—A detailed account of work previously reported (cf. A., 1940, I, 50). The work functions determined photo-electrically by Fowler's method of analysis were compared with the contact p.d. measured by the Kelvin null method. When outgassed Ag is deposited by vaporisation on the crystal faces there is evidence that a more gas-free surface is obtained than by heating alone. Results are explained by postulating that long heating produced a stable gas configuration of a unimol. surface layer, and that the surface after deposition was mainly free from this gas. The work function in the latter case was less by 0·09±0·03 v.   N. M. B.

Energy losses attending field current and thermionic emission of electrons from metals. G. M. Fleming and J. E. Henderson (*Physical Rev.*, 1940, [ii], **58**, 887—894).—Measurements in the same tube were made by observing the thermal e.m.f. in a junction from which the emission currents were drawn. No measurable temp. change was observed for field emission up to thermionic temp. For thermionic emission, temp. changes were observed which, when correlated with power losses from the filament as a function of temp., yield the val. 4·46±0·09 v. for the work function of W. Results strongly support the view that in field emission the electrons escape by penetrating rather than by surmounting the surface potential barrier as in thermionic emission. An expression for the average net energy loss per electron emitted in thermionic and field current emission is deduced.   N. M. B.

Temperature dependence of the work function of tungsten. (A) W. B. Nottingham. (B) J. G. Potter (*Physical Rev.*, 1940, [ii], **58**, 927—928, 928).—(A) A criticism of Potter (cf. A., 1940, I, 1).
(B) A reply.   N. M. B.

Mechanism of spark discharge in air at atmospheric pressure. I. L. B. Loeb and J. M. Meek (*J. Appl. Physics*, 1940, **11**, 438—447).—The inadequacy of the Townsend equation for explaining sparks in air at ~atm. pressure is shown, and the mechanisms active in air at higher pressures are given. A quant. criterion for streamer formation leads to a quant. theory for spark breakdown in air at atm. pressure, and this accords with experiment and predicts departures from Paschen's law. The theory is applied to longer sparks at atm. pressures and the effect of the decrease in density of photo-ionisation in longer avalanches is considered. Resulting modification of Meek's mechanism (cf. A., 1940, I, 276) is discussed, and the mechanism is correlated with the passage of lightning discharges.   N. M. B.

Neutralisation and ionisation on a thoriated tungsten surface. N. D. Morgulis, M. P. Bernadiner, and B. I. Djatlovitzkaja (*J. Physics, U.S.S.R.*, 1940, **2**, 25—38).—The neutralisation of Cs* and K* and the ionisation of Cs, K, and Na at 1400° к., and at 1700° к. for Na, on the surface of thoriated W at different degrees of activation (θ) or effective work functions (ϕ) have been investigated. With increasing θ the coeff. of neutralisation (*i.e.*, the ratio of the no. of ions leaving to the no. of atoms striking the surface) increases whilst the coeff. of ionisation (*i.e.*, the ratio of the no. of atoms striking to the no. of ions leaving the surface) decreases. Both processes are always determined by vals. of ϕ, undistorted by the contact field, which correspond with local vals. at spots where atoms or ions directly strike the surface and thus differ from the escape of electrons from the surfaces for which ϕ has an average val. over the entire surface. From detailed analysis of the experimental data the Th film on the W surface is considered to possess a non-uniform (spotted) surface.   W. R. A.

Electrical discharges in gases and their applications. I. V. J. Francis and H. G. Jenkins (*Physical Soc. Rep. Progr. Physics*, 1940, **7**, 230—302).—A progress report.   W. J.

Excitation of atoms in a rare gas discharge. K. Panevkin (*J. Physics, U.S.S.R.*, 1940, **2**, 39—48).—Existing theoretical and experimental data on the influence of current on concn. of excited atoms in rare-gas discharges (He, Ne, and A) are critically discussed. Existing data and probe measurements indicate that the dependence of concn. of excited atoms on current is determined by variation in the electron temp. with current. With increase of current the electron temp. falls but the electron concn. increases. The superposition of these two factors gives a max. for the no. of exciting collisions with a certain magnitude of current at which saturation concn. of the excited atoms occurs. Previous theories assume shortening of the life of excited atoms by collisions of a de-activating type whilst from the viewpoint presented the life is considered const.   W. R. A.

Formation and maintenance of electron and ion beams. L. P. Smith and P. L. Hartman (*J. Appl. Physics*, 1940, **11**, 220—229).—The radial potential distribution in an ionic beam of circular cross-section is calc. and the max. beam current which can be obtained with a beam of given radius and boundary conditions is derived. Methods of preventing divergence of an ionic beam during the initial acceleration process are discussed.   O. D. S.

Acceleration of electrons by magnetic induction. D. W. Kerst (*Physical Rev.*, 1940, [ii], **58**, 841).—Using a laminated electromagnet with 8 in. diameter pole faces and a 600-cycle per sec. magnetic field, electrons of estimated energy ~2·2 Me.v. were accelerated to produce X-rays by impact on a W target. The estimated electron energy prior to impact was ~2·25 Me.v.   N. M. B.

Fresnel diffraction of electrons as a contour phenomenon in electron supermicroscope images. J. Hillier (*Physical Rev.*, 1940, [ii], **58**, 842; cf. A., 1939, I, 433).—Photographs taken with an improved electron microscope show a new type of contour at the image of the line of separation of two areas of the specimen having widely different at. mass thicknesses, and similar in appearance to the diffraction effects with a light microscope. Their origin and explanation are discussed.   N. M. B.

Radiation emitted by uniformly moving electrons. I. Tamm (*J. Physics, U.S.S.R.*, 1939, **1**, 439—454; cf. A., 1937, I, 220).—Mathematical. The theory of the radiation emitted by an electron moving uniformly in a ponderable medium with velocity > that of light in the medium is extended, and the effects of loss of energy by collisions, ionisation, etc. are considered.   L. J. J.

Specific charge of the positron. A. H. Spees and C. T. Zahn (*Physical Rev.*, 1940, [ii], **58**, 861—864; cf. A., 1938, I, 223).—Direct comparisons between electrons and positrons obtained from artificially radioactive Cu were made for β-particles of velocity $\beta = \sim 0.72$. Results indicate that e/m_0 for positrons is the same (±2%) as for electrons.   N. M. B.

Mobility of positive ions in their own gas. R. J. Munson and A. M. Tyndall (*Proc. Roy. Soc.*, 1941, **A**, **177**, 187—191).—The mobility of Ne^+ in Ne, A^+ in A, Kr^+ in Kr, and Xe^+ in Xe was measured. The mobilities can be calc. from the known mobilities of alkali ions in the gases; the observed val. is < that calc., the difference being attributed to the phenomenon of electron exchange in the case of ions in their own gas. The variation of mobility with field E and pressure

p was studied. In Kr and Xe the mobility falls with rise of E/p.   G. D. P.

Mobility of alkali ions in gases. IV. Measurements in gaseous mixtures. H. G. David and R. J. Munson. V. Temperature measurements in the inert gases. K. Hoselitz (*Proc. Roy. Soc.*, 1941, **A, 177**, 192—199, 200—204; cf. A., 1939, I, 544).—IV. In binary mixtures of inert gases the reciprocal of the mobility of alkali ions is a linear function of the concn. with the exception of Li⁺ in He–Xe mixtures. With clustered Li⁺ ions in mixtures of an inert gas and aq. vapour, deviations from the simple law are observed which increase with the density of the gas. The effect is ascribed to the increasing size of the clustered ion with increasing % of aq. vapour.

V. The temp. variation of the mobility of Li⁺ in He, K⁺ in A, Rb⁺ in Kr, and Cs⁺ in Xe was measured over a range of temp. The results show that the approx. agreement with theory, previously found in the case of Cs⁺ and Na⁺ in He, is not general.   G. D. P.

Negative-ion formation in iodine vapour by electron impacts. R. Buchdahl (*J. Chem. Physics*, 1941, **9**, 146—152).—The negative-ion formation in I vapour has been studied by Lozier's method (A., 1934, 1159) with electron velocities 0—7 e.v. The kinetic energies of the ions produced by electrons of different energies indicate that all are produced by the reaction $I_2 + e = I' + I$. The probability of collision resulting in ionisation is 10^{-4}—10^{-3}. The electron affinity of the I atom, calc. from the dissociation energy of the neutral mol. and the kinetic energies of the electrons and ions, is 3.0 ± 0.2 e.v.   J. W. S.

Ferromagnetic anisotropy and the itinerant electron model. H. Brooks (*Physical Rev.*, 1940, [ii], **58**, 909—918).—Mathematical. The itinerant or collective electron concept in the theory of metals is applied, through Bloch's " approximation of tight binding," to explain the quenching of orbital angular momentum in solids, and, through the introduction of l, s coupling, ferromagnetic anisotropy in cubic crystals. The anisotropy appears in the fourth approximation and has the correct order of magnitude for Fe and Ni. A qual. discussion of the behaviour of Fe–Ni alloys is given.
       N. M. B.

Eleventh report of the committee on at. wts. of the International Union of Chemistry. G. P. Baxter, M. Guichard, O. Hönigschmid, and R. Whytlaw-Gray (*J.C.S.*, 1941, 146—151).—Recent work on the at. wts. of C, S, P, K, I, Cs, and Ho is summarised, and in the case of Ho the new val. 164·94 is adopted, the other at. wts. remaining unchanged. Attention is directed to discrepancies between chemical and mass-spectrographic vals. for Sc, Tb, Tm, Ir, and Au.   F. J. G.

New radioactive transition series. W. Wahl (*Finska Kem. Medd.*, 1940, **49**, 88—92).—The mass-spectra of two (unspecified) U minerals contain a weak mass-line 237, which is absent from monazites and Varuträsk and Willberforce uraninites and thus cannot be a Th or U isotope. 237 must be a member of a new radioactive series, with end product ²⁰⁵Pb or ²⁰⁹Pb, and a faint line at 205 occurs in the spectra containing the 237 line. It is suggested that the atom responsible is ²³⁷Pa derived from the hypothetical ²⁴¹U.
       M. H. M. A.

β-Radiation of radium-*A* and the formation of the element of nuclear charge 85. W. Minder (*Helv. Phys. Acta*, 1940, **13**, 144—152).—The increase of β-radiation of Ra emanation and its disintegration products with time has been determined up to 13 min. This increase is initially > that required by theory on the assumption that Ra-*B* and Ra-*C* are formed, but can be explained if it is assumed that a soft β-radiation from Ra-*A* is present. The latter is almost completely absorbed by material of 1 mm. air equiv. After the absorption, the remaining radiation agrees with that due to Ra-*B* + Ra-*C*. The β-radiation from Ra-*A* amounts to ∼15% of that from Ra-*B*. If this β-radiation arises from Ra-*A* the element with at. no. 85 must be produced. The name *helvetium* (Hv) is proposed for it, but chemical identification has not yet proved successful.   A. J. M.

Application of the coincidence method for measurements of short life periods. J. Rotblat (*Proc. Roy. Soc.*, 1941, **A, 177**, 260—271).—A method for the determination of radioactive life periods in the range 10^{-7} to 10^{-1} sec. is described. The half-life period of Ra-*C'* was found to be 1.45×10^{-4} sec.

Evidence was obtained for the absence of γ-rays in the transition Ra-*C'* → Ra-*D*, and some conclusions regarding the lifetimes of excitation states of Ra-*C'* have been drawn. The application of the method to the determination of the intensity of weak sources and the efficiency of Geiger counters is discussed.   G. D. P.

β-Decay. A. Zavelski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 12—15).—The continuous β-spectra of ³²P, Th-*C''* corr. to $Z = 0$ by application of Fermi's theory (A., 1934, 579), and Ra-*E* corr. to $Z = 0$, and adjusted to the same upper limit of energy as ³²P and Th-*C''*, are compared with the curve deduced from Fermi's theory. All the spectra are less symmetrical than the theoretical curve, giving a greater no. of slow electrons. It is suggested that this variation is due to the dependence of the shape of the spectrum on the change in momentum of the nucleus. The unsymmetry is more pronounced in the order ³²P > Ra-*E* > Th-*C''* > theoretical curve, *i.e.*, in the order of the line in Sargent's diagram (A., 1933, 443) to which the elements belong. Comparison with other experimental data shows that these curves are typical for elements belonging to lines 3 (³²P), 2 (Ra-*E*), and 1 (Th-*C''*) of Sargent's diagram.   O. D. S.

Anomalous scattering of neutrons by helium. II. H. Staub and H. Tatel (*Physical Rev.*, 1940, [ii], **58**, 820—828; cf. A., 1939, I, 171).—A closer investigation of the anomalous scattering by He of neutrons at ∼1 Me.v. energy shows a backward scattering cross-section peak of 0·4 Me.v. half-width and indicates a doublet structure with a splitting of ∼0·3 Me.v. The redetermined abs. ratio of He and H scattering cross-sections at 2·5 Me.v. neutron energy was ≪ that previously found. The resulting lower abs. vals. of the resonance scattering cross-section are still consistent with the assumption of a P resonance level, and measurements agree with the dispersion theory.   N. M. B.

Resonance scattering of protons and neutrons on helium. F. Bloch (*Physical Rev.*, 1940, [ii], **58**, 829—836; cf. preceding abstract).—Mathematical. A development of general dispersion theory in which the wave function describing a resonance process appears as a monochromatic Fourier component of a wave packet which is built in such a way that it represents for $t > 0$ the decay of a compound state and for $t < 0$ the building up of the same compound state. The method is applied to the resonance P scattering of protons and neutrons on He.   N. M. B.

Capture cross-sections for thermal energy neutrons. II. F. Rasetti (*Physical Rev.*, 1940, [ii], **58**, 869—870; cf. A., 1940, I, 426).—The intensity of the β-activity induced under standard neutron irradiation is determined, and the no. of neutrons is measured by using as standard the activity induced in Mn. Data thus obtained are reported for slow neutron capture by ²³Na, ²⁷Al, ³¹P, ⁴¹K, ⁵¹V, ⁶³Cu, ⁶⁵Cu, ⁷⁵As, ⁷⁹Br, ¹²¹Sb, and ¹²⁷I.   N. M. B.

Capture cross-sections for slow neutrons. K. Sinma and F. Yamasaki (*Sci. Papers Inst. Phys. Chem. Res. Tokyo*, 1941, **38**, 167—173, and *Physical Rev.*, 1941, [ii], **59**, 402—403).—From measurements of the intensity of β-rays from induced radioactive substances produced by neutron capture the relative capture cross-sections of 50 isotopes for slow neutrons have been determined and the abs. cross-sections have been calc.   W. R. A.

Laws of nuclear structure derived from nuclear spins. S. Tolansky (*Nature*, 1941, **147**, 269; cf. A., 1936, 1040).—For stable atoms of odd at. wt. the three laws for nuclear structure are : (i) in stable at. nuclei with an odd nuclear neutron, the spin and angular momenta of the lightly bound or odd particle(s) tend to oppose each other, (ii) in stable at. nuclei with an odd nuclear proton, the addition of 2 neutrons does not alter the nuclear spin, and (iii) in stable at. nuclei with an odd nuclear neutron, the addition of 2 neutrons may increase the nuclear spin. As a corollary to (ii) it is stated that when 2 neutrons are added in presence of an odd proton, the neutrons set themselves with their spins in opposition.
       L. S. T.

Disintegration of ¹⁴N and ¹⁵N by deuterons. M. G. Holloway and B. L. Moore (*Physical Rev.*, 1940, [ii], **58**, 847—860; cf. A., 1939, I, 592).—A mixture of ¹⁴N and ¹⁵N was bombarded with 1-Me.v. deuterons and the ranges of the disintegration particles were measured with a shallow ionisation chamber and pulse amplifier. The shortest measurable range was

2·1 cm. (15°, 760 mm.). The reaction ^{15}N (d, a) ^{13}C gave one group of a-particles (5·25 cm. range, $Q = 7·54$ Me.v), and ^{14}N (d, a) ^{12}C gave three groups of a-particles (11·97 cm., $Q = 13·39$; 6·54 cm., $Q = 9·02$; 3·47 cm., $Q = 5·77$ Me.v). The reaction ^{14}N (d, p) ^{15}N gave two groups of protons (90·5 cm., $Q = 8·51$; 21·02 cm., $Q = 3·15$ Me.v). A group previously reported at 66 cm. was due to B contamination. No proton groups due to ^{15}N (d, p) ^{16}N were found, although an activity of half-life 9·5±1·0 sec. arose from deuteron bombardment of $^{14}N + ^{15}N$, but not from ^{14}N alone. N. M. B.

Gamma radiations emitted in nuclear processes. N. Feather (*Physical Soc. Rep. Progr. Physics*, 1940, 7, 66—86).—A progress report. W. J.

Short-lived radioactivities of $^{27}_{14}Si$, $^{31}_{16}S$, and $^{35}_{18}A$. L. D. P. King and D. R. Elliott (*Physical Rev.*, 1940, [ii], 58, 846; cf. Barkas, A., 1940, I, 400).—Using 16-Me.v. a-particles, the following new reactions and half-lives have been observed: $^{24}_{12}Mg$ (a, n) $^{27}_{14}Si$ (4·92 sec.); $^{28}_{14}Si$ (a, n) $^{31}_{16}S$ (3·18 sec.); $^{32}_{16}S$ (a, n) $^{35}_{18}A$ (1·91 sec.). Assignments by non-chemical means are discussed. N. M. B.

Long-lived isotope of yttrium. C. Pecher (*Physical Rev.*, 1940, [ii], 58, 843).—From Sr bombarded with 16-Me.v. deuterons from a cyclotron, radioactive Y (~100 days) was separated. It is probably ^{86}Y produced by a $1d$—$2n$ reaction from ^{86}Sr (cf. Du Bridge, A., 1940, I, 340), and emits a penetrating γ-radiation giving an absorption curve in Cu, Pb, and Fe almost identical with that of Ra γ-rays; it appears suitable for radiography. The yield is ~12 mg. Ra equiv. per 1000 μ-amp.-hr. of 16-Me.v. deuterons. N. M. B.

Electro-capillary theory of the splitting of heavy elements by slow neutrons. J. Frenkel (*J. Physics, U.S.S.R.*, 1939, 1, 125—136; cf. A., 1939, I, 398).—Mathematical. A theory of the splitting of a heavy nucleus into two parts of comparable size is developed by analogy with the instability of an electrically charged liquid drop. The drop becomes unstable when the ratio γ of its electrical to its surface energy reaches a crit. val. ~2·17. For all known elements γ is <2·17 but that of U probably approaches the crit. val. closely. It is shown that for $\gamma \ll 2$ the spherical shape is unstable. For arbitrary vibrations about the spherical shape of a liquid drop with a uniformly distributed vol. charge the frequency of the fundamental mode becomes 0 when γ reaches the val. 2. If the val. of γ is close to the crit. val. the energy of capture of a neutron may be sufficient to cause explosive rupture of the nucleus. The mechanism of this rupture is discussed. O. D. S.

Chemical nature of the radioactive fragments of thorium fission. Radioactive halogens. I. A. Polesitzki and M. Orbeli. II. A. Polesitzki and N. Nemerovski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, 28, 215—216, 217—218).—I. On irradiation with fast neutrons, $Th(NO_3)_4$ yields two forms of radioactive I with half-life periods 1 and 15 hr., respectively (cf. Dodson and Fowler, A., 1939, I, 350). Evidence is obtained that the I of shorter life is formed from a Te isotope of half-life period 40 min.

II. By copptn. with inactive Te and subsequent distillations with KI and KNO_2 it is shown that $ThCl_4$, after irradiation with fast neutrons, yields radioactive Te of half-life period 78 hr., which decays to give radioactive I of half-life period 2·4 hr. Subsequent distillation with $KBrO_3$ and KBr, reduction of the Br in Na_2SO_3, and pptn. as AgBr shows the presence of two Br isotopes with half-life periods 45 min. and 4·5 hr., respectively. J. W. S.

Nuclear fission fragments as radioactive indicators of iodine exchange between silver iodide and solution of iodide. A. Polesitzki (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, 28, 441).—Radioactive I of half-life 15 hr. was obtained by the fission of Th by fast neutrons. This I was used to study the exchange of I between AgI and KI solution. There was a rapid exchange at the start which decreased considerably later. More " aged " AgI showed a much slower exchange.

A. J. M.

mv/E relation for products of uranium fission. N. A. Perfilov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, 28, 426—428).—When U is bombarded with neutrons, comparatively highly charged particles are emitted. The magnitude of the charge can be determined by deflecting the particles in a magnetic field in vac. The trace of the deflected particles was obtained on a photographic plate with a thick emulsion,

in which tracks of protons failed to give a clear picture, and a-particles may be easily detected. The val. of mv/E was found to be $6·6 \times 10^{-5}$ e.m.u. Assuming the energy vals. for the two recoil nuclei to be 91 Me.v. and 57 Me.v., respectively, and the masses 90 and 144, respectively, the effective charge is 20e. A. J. M.

Heat of fission of uranium. M. C. Henderson (*Physical Rev.*, 1940, [ii], 58, 774—780; cf. A., 1939, I, 593; Turner, A., 1940, I, 340).—The heat produced during slow-neutron bombardment in a 13·36-g. sample of metallic U was measured on a resistance thermometer. Simultaneously the no. of fissions produced in a 54-μg. layer of U was counted by an ionisation chamber and pulse amplifier. The vals. found were 40 μ-watts and 340 fissions per min., respectively, giving an average heat of fission of 177 Me.v. ±1% per fission.

N. M. B.

Velocity–range relation for fission fragments. N. Bohr, J. K. Bøggild, K. J. Brostrøm, and T. Lauritsen (*Physical Rev.*, 1940, [ii], 58, 839—840; cf. A., 1941, I, 3).—Statistical analysis supports evidence obtained from range measurements of tracks and from the counting of branches at various parts of the range of a large no. of tracks in U targets that there are two broad groups of tracks with 22 and 29 cm. range in air, indicating the presence of two main groups of fragments, as shown in chemical analysis of the fission products but not clearly shown in the cloud-chamber tracks. Curves for the two groups are given. N. M. B.

Successive transformations in nuclear fission. N. Bohr (*Physical Rev.*, 1940, [ii], 58, 864—866; cf. A., 1940, I, 53).—Mathematical. Assuming that fission of heavy nuclei takes place in competition with the escape of a neutron from the highly excited compound system, fission of the residual nucleus after neutron escape would still be expected, for sufficiently high excitation of the system. Since conditions for competition with neutron escape are often more favourable in this second stage, such effects may give rise to much increased cross-sections for the fission process. N. M. B.

Deuteron-induced fission in uranium and thorium. I. C. Jacobsen and N. O. Lassen (*Physical Rev.*, 1940, [ii], 58, 867—868).—Determination by means of deuteron beams from a cyclotron of the variation with deuteron energy of fission yield for U and Th showed, in both cases, a rapid rise at 8—9·5 Me.v. For 9 Me.v. the estimated cross-section in U is 5×10^{-27} sq. cm., and for this energy the U–Th cross-section ratio is 0·7, supporting the theoretical expectation of successive transformations (cf. preceding abstract).

N. M. B.

Identification of two radioactive xenons from uranium fission. C. S. Wu (*Physical Rev.*, 1940, [ii], 58, 926; cf. A., 1940, I, 187; Dodson, *ibid.*, 307).—Cs placed behind a Be target bombarded with 16-Me.v. deuterons gives an activity of half-life 5 days. Ba similarly treated gives activities of half-life 9·4 hr. and 5 days. Periods and absorption curves identify these with radioactive Xe from U and Th fission. The Cs reaction is assumed to be $^{133}_{55}Cs$ (n, p) $^{133}_{54}Xe$. Evidence is given that the Ba reactions are $^{136}_{56}Ba$ (n, a) $^{133}_{54}Xe$ (5 days), and $^{138}_{56}Ba$ (n, a) $^{135}_{54}Xe$ (9·4 hr.). Hence the two chains found in U and Th fission are identified as $^{133}_{52}Te$ (60 min.) $\rightarrow$ $^{133}_{53}I$ (22 hr.) $\rightarrow$ $^{133}_{54}Xe$ (5 days) $\rightarrow$ $^{133}_{55}Cs$, and $^{135}_{52}Te$ (~10 min.) $\rightarrow$ $^{135}_{53}I$ (6·6 hr.) $\rightarrow$ $^{135}_{54}Xe$ (9·4 hr.) $\rightarrow$ $^{135}_{55}Cs$ (?). I (12·6 hr.) was separated from the fast-neutron-activated Cs, confirming the assignment $^{130}_{53}I$ resulting from the reaction $^{133}_{55}Cs$ (n, a) $^{130}_{53}I$ (cf. Livingood, A., 1939, I, 54). N. M. B.

Production of secondary ionising particles by non-ionising agents in cosmic radiation. B. Rossi, L. Jánossy, G. D. Rochester, and M. Bound (*Physical Rev.*, 1940, [ii], 58, 761—766; cf. Schein, A., 1940, I, 308).—Experiments with various arrangements of counters show that the influence of the position of the absorber on the counting rate of a vertical counter arrangement near sea level is due mainly to scattering, knock-on showers, showers from the air, etc., rather than to penetrating non-ionising particles producing ionising secondary rays or to photons producing mesotrons.

N. M. B.

Mean lifetime of the mesotron from electroscope data. H. V. Neher and H. G. Stever (*Physical Rev.*, 1940, [ii], 58, 766—770).—Cosmic-ray intensities were measured at various depths in two lakes, one ~12,000 ft. above the other, but of the same geomagnetic latitude. The difference in depths of the two sets of measurements was about equal in mass to

the air between the lakes. Assuming air and H_2O to be g. for g. equiv. absorbers for the mesotrons involved, the ratio of intensities at equiv. points in the two lakes was calc., and by matching this with the observed ratios a val. $2 \cdot 8 \times 10^{-6}$ sec. for the mean rest lifetime of a rest mass of 160 times that of the electron was found.   N. M. B.

Neher–Stever experiment. E. Nelson (*Physical Rev.*, 1940, [ii], **58**, 771—773).—Three problems important to the quant. interpretation of experiments (cf. preceding abstract) are discussed. The correct treatment of the altitude effect in the energy distribution is important in determining the decay const. of the mesotron. The fraction of mesotrons decaying is independent of the zenith angle. The absorption in H_2O of cascades produced by decay electrons, calc. from Serber's shower theory, agrees with experiment, showing that one but not both of the decay products is shower-producing.   N. M. B.

Production of mesotrons by penetrating non-ionising rays. B. Rossi and V. H. Regener (*Physical Rev.*, 1940, [ii], **58**, 837—838).—Experiments at 4300 m. above sea level with special arrangements of counters give definite evidence of the production of mesotrons by non-ionising rays (cf. Schein, A., 1940, I, 308), and indicate that the rays are more penetrating than photons and may be neutrettos (neutral mesotrons) or high-energy neutrons.   N. M. B.

Effect of an eclipse on cosmic rays. A. H. Compton (*Physical Rev.*, 1940, [ii], **58**, 841).—A preliminary statement claiming the existence of an observed effect.   N. M. B.

Absorption of cosmic rays in lead at a depth of 1000 m. water equivalent. J. Barnóthy and M. Forró (*Physical Rev.*, 1940, [ii], **58**, 844—845).—A repetition of experiments previously reported (cf. A., 1939, I, 351), but with 70 cm. of wood replacing a 2·5-cm. Pb shield, confirms a min. intensity at 10 cm. of Pb followed by an increase, and a second min. at 42 cm. of Pb. A qual. explanation is proposed by assuming that at such depths only a non-ionising radiation is present which produces secondaries with 10 cm. Pb range in the clay or brick layer and ionising secondaries with 25 cm. Pb range in Pb. The min. at 42 cm. of Pb is explained by assuming that in wood another kind of more penetrating particles with well-defined ranges of 40 cm. of Pb is created. These rays may be protons, and those in clay or Pb may be mesotronic.   N. M. B.

Disintegration of atomic nuclei by cosmic rays. A. Filippov, A. Shdanov, and I. Gurevitsch (*J. Physics, U.S.S.R.*, 1939, **1**, 51—65).—Tracks from the disintegration of nuclei with the emission of from 1 to 5 heavy particles have been observed on photographic plates with emulsion 50 μ. thick and are described. Showers of protons making small angles with one another and processes accompanied by the emission of protons and mesotrons have been observed. Calc. energies of disintegration are ~20 Me.v. for disintegration into three and >60 Me.v. for disintegration into six particles.   O. D. S.

Maximum energy which primary electrons of cosmic rays can have on the earth's surface due to radiation in the earth's magnetic field. I. Pomerantschuk (*J. Physics, U.S.S.R.*, 1940, **2**, 65—69).—The radiation of the primary electrons of cosmic rays in the earth's magnetic field is considered. Calculation based on classical electrodynamics indicates that the radiation will play an important rôle beginning with electron energies of 10^{16} e.v. The electron energy, E_g, at the earth's surface is due to this radiation, related to its energy at infinity, E_0, by $E_g = E_0 E_c/(E_0 + E_c)$, where E_c is ~10^{17} e.v. and depends on geomagnetic latitude and the angle of incidence of the electron. The spectrum of primary electrons entering the earth's atm. may have energies ~10^{17} e.v. due to radiation in the magnetic field.   W. R. A.

Registration of mesotrons by means of thick-emulsion photographic plates. A. Shdanov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 110—114).—Tracks with abnormally widely spaced grains observed in photographic emulsions exposed to cosmic-ray showers are attributed to mesotrons. Their characteristics agree with mesotron properties as observed by Corson and Brode (A., 1938, I, 382).   O. D. S.

Origin and nature of heavy ionisation particles detected on photographic plates exposed to cosmic rays. D. M. Bose and (Miss) B. Chowdhry (*Nature*, 1941, **147**, 240—241).—Additional evidence that supports previous conclusions (A., 1940,

I, 341) is recorded. The component of the cosmic ray responsible for producing heavy ionisation tracks in photographic plates is more strongly absorbed in H_2O than in air; it is probably neutrons.   L. S. T.

Radio echoes and cosmic-ray showers. P. M. S. Blackett and A. C. B. Lovell (*Proc. Roy. Soc.*, 1941, **A, 177**, 183—186).

Seasonal variations of cosmic-ray intensity and temperature of the atmosphere. A. Duperier (*Proc. Roy. Soc.*, 1941, **A, 177**, 204—216).—Examination of the upper atm. data shows that there is a lag in the warming of the atm. in spring which is correlated with diminution of intensity of cosmic rays. A similar though less marked phenomenon is found in autumn. The cosmic-ray variations are more closely connected with the mean temp. of the atm. up to 16 km. than with the temp. near the ground. This supports the view that the temp. variation of penetrating cosmic rays is related to the instability of the mesotron.   G. D. P.

Bohr theory of nuclear reactions. R. Peierls (*Physical Soc. Rep. Progr. Physics*, 1940, **7**, 87—106).—A progress report.   W. J.

Ratio of e, c, and h. A. Landé (*Physical Rev.*, 1940, [ii], **58**, 843).—If $a^2\pi$ is identified with $2\pi\phi$, *i.e.*, $\gamma = (2\pi 8/3)^{\frac{1}{2}}$, where $a =$ " radius," and $\phi =$ the universal scattering cross-section, then a^{-1} (where $a = e^2/ch = \mu/\gamma$) has the val. $137 \cdot 1273$ in exact agreement with experiment. The physical origin of the factor 2π is unexplained.   N. M. B.

Calculation of force fields from scattering. F. C. Hoyt and W. E. Frye (*Physical Rev.*, 1940, [ii], **58**, 784—786; cf. A., 1939, I, 304).—Mathematical. A method is developed for calculating the field which gives an observed scattering on the assumption that the interaction can be represented by a central field and that the phase shifts can be calc. by the WKB approximation. Application to electronic and nuclear scattering is discussed.   N. M. B.

Elastic scattering in helium at 15°. R. L. Mooney (*Physical Rev.*, 1940, [ii], **58**, 871—873).—Mathematical. Margenau's interaction energy is used in a form modified for small vals. of the separation parameter, and an angular distribution function is obtained for the scattered intensity of head-on collisions of parallel beams of He atoms with relative velocities appropriate to 15°. The scattering curve does not show the regularity obtained in smooth-sphere model calculations, but the expected max. at 90° is present. The calc. total collision cross-section is 1228×10^{-16}, and the diffraction cross-section is $34 \cdot 21 \times 10^{-16}$ compared with the viscosity cross-section $14 \cdot 93 \times 10^{-16}$ sq. cm.   N. M. B.

Possible Kronig fine-structure in X-ray emission spectra. S. T. Stephenson (*Physical Rev.*, 1940, [ii], **58**, 877—878; cf. A., 1941, I, 138).—A comparison with Kronig K-absorption fine-structure for Cu shows that weak Cu emission bands observed extending 34 X. out on the short-λ side of Cu $K\beta_2$ are caused by absorption of the X-rays while emerging from the Cu target.   N. M. B.

Gaseous model of atomic nuclei. J. Frenkel and V. Tscherdincev (*J. Physics, U.S.S.R.*, 1940, **2**, 55—64).—Theoretical. By treating heavy at. nuclei as a degenerated Fermi gas composed of protons and neutrons, a relation between at. wt. and at. no. has been determined quantitatively. The no. of stable isobars and isotopes has also been determined. Deviation of electric density from a const. val. is insignificant. The size of nuclei is found from the condition of energy min. using a Yukawa potential, and an estimation of the thermal expansion coeff. and the relaxation time is attempted. The possibility of the existence of intranuclear α-particles is considered, and it is concluded that in all heavier nuclei protons are practically all passed into such particles.   W. R. A.

Scattering of α-particles by light nuclei. V. V. Maljarov (*J. Physics, U.S.S.R.*, 1940, **2**, 75—80).—Theoretical. The anomalous scattering in ^{4}He and ^{12}C is explained by the existence of compound systems in two excited states.   W. R. A.

Classical theory of the scattering of mesons. D. Ivanenko (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 411—414).—The theory is developed by the introduction of a Hertz vector. The motion of a heavy nucleus is described non-relativistically, the quasi-electric part of the momentum tensor and the magnetic part of the total polarisation tensor

being neglected. Formulæ are deduced for the quasi-electric and quasi-magnetic scatterings on the asssumption that the nuclons are point particles. A generalisation of the theory is proposed in the form of a non-linear theory. This leads to the introduction of quasi-electric and magnetic nuclear form factors, making scattering at small angles more probable. The experiments of Bothe and Schmeiser on hard showers seem to indicate the existence of such small-angle scattering.
A. J. M.

Scattering of mesons. A. Sokolov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 16—18).—Mathematical. The scattering of neutral mesons by free nuclons (*i.e.*, heavy particles, proton + neutron) is discussed.   O. D. S.

Quantum theory of emission of elementary particles. A. Sokolov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 415—417).—A consistent theory describing the emission of photons for which the energy, $h\omega$, is known to equal the product of impulse, $h\chi$, and velocity of light, c ($\omega = c\chi$), can be developed on the basis of quantum mechanics. The case where $\omega < c\chi$ is now dealt with.   A. J. M.

II.—MOLECULAR STRUCTURE.

Two new electron levels of CO. V. M. Tschulanovski (*J. Physics, U.R.S.S.*, 1939, **1**, 341—346).—The spectrum of CO from 1000 to 1300 A. has been analysed and discussed. Two band-systems $^1\Sigma \rightarrow {}^1\Sigma$ ($\nu_{00} = 90,866$ cm.$^{-1}$) and $^1\Pi \rightarrow {}^1\Sigma$ ($\nu_{00} = 98,791$ cm.$^{-1}$) were found, and their vibrational and rotational consts. calc.   A. J. M.

Interaction of various components of a $^3\Sigma$ with a $^1\Pi$ level. B. L. Stepanov (*J. Physics, U.S.S.R.*, 1940, **2**, 81—88).—The form of the matrix elements of interaction between the levels $^1\Pi$ and $^3\Sigma$ has been investigated particularly with respect to the perturbations of the level $v = 0$ in the $A^1\Pi$ state of CO.   W. R. A.

Shape of perturbation curves for the intersection of levels $^3\Sigma$ and $^1\Pi$ of the diatomic molecule. B. L. Stepanov (*J. Physics, U.S.S.R.*, 1940, **2**, 89—95).—The approximation given by Kovacs and Budo (A., 1938, I, 602) for the intersection does not always hold. At the point of intersection of two levels a third level exerts a distorting effect.   W. R. A.

Band spectrum of germanous sulphide in emission. R. F. Barrow (*Proc. Physical Soc.*, 1941, **53**, 116—119; cf. A., 1940, I, 343).—The band spectrum of GeS, previously known only in absorption, was excited in emission by means of a heavy-current uncondensed discharge through a mixture of S and GeO$_2$ in a SiO$_2$ tube, in presence of Al. Data for ~20 new bands in the region $\lambda\lambda$ 3350—3750, assigned to the long-λ end of the main system of GeS, are tabulated. Analysis confirms available absorption data.   N. M. B.

Vibration analysis of the chlorine dioxide absorption spectrum. J. B. Coon (*Physical Rev.*, 1940, [ii], **58**, 926—927; cf. Ku, A., 1933, 1102).—Replacing the fundamental frequency of 528 cm.$^{-1}$ by 447 cm.$^{-1}$ which appears as a const. difference in three separate pairs of progressions, a new analysis of the electronic band system at 2600—5225 A. in ClO$_2$ absorption is reported. All distinct bands excluding isotope bands are grouped into 12 progressions; all other reported bands are classed as sub-bands, or are in the ultra-violet where predissociation causes confusion.   N. M. B.

Infra-red spectra of polyatomic molecules. H. Nielsen (*Physical Soc. Rep. Progr. Physics*, 1940, **7**, 41—65).—A progress report.   W. J.

Absorption spectra of chrome alums at low temperatures. D. L. Kraus and G. C. Nutting (*J. Chem. Physics*, 1941, **9**, 133—145).—The line absorption spectra of single crystals of 13 Cr sulphate and selenate alums have been measured at 85° and 15° or 20° K. over the λ range 6250—6900 A. The majority show a strong doublet, together with fainter lines, near 6700 A. In another class the spectrum is shifted towards longer λ and the doublet is replaced by strong sharp line at ~6900 A., whilst a third class has ~6 strong lines near 6700 A. These differences are correlated with the lattice structure consequent on the varying sizes of the univalent cations. Transitions which disrupt the lattice, causing the crystal to become opaque, occur in NH$_4$Cr(SO$_4$)$_2$,12H$_2$O and NH$_4$Cr(SeO$_4$)$_2$,12H$_2$O at 81°±1° and 106°±5° K., respectively. Combinations of the electronic frequencies of Cr$^{...}$ with internal oscillations of anions are weak, but combinations of lattice vibrations with both the upper and lower electronic states of Cr$^{...}$ are observed. In all cases bands occur shifted ~330, 570, and 800 cm.$^{-1}$ to higher frequencies than the electronic absorption lines. These are attributed to photo-excitation of a non-homopolar complex, probably Cr(H$_2$O)$_6$$^{...}$.   J. W. S.

Infra-red transmission of thin films of various organic materials. A. J. Wells (*J. Appl. Physics*, 1940, **11**, 137—140).—Data are recorded between 400 and 3000 cm.$^{-1}$ for Cellophane, ethylcellulose, cellulose acetate, Duco household cement, polystyrene, glyptal, Pliofilm, rubber, Plexiglas, Me methacrylate polymer, XYSG Vinylite, and Shawinigan V-15 resin. The possibility of using these materials for windows in spectroscopic work is discussed.   L. J. J.

Features and implications of the near infra-red absorption spectra of various proteins. Gelatin, silk fibroin, and zinc insulinate. (Miss) J. D. Bath and J. W. Ellis (*J. Physical Chem.*, 1941, **45**, 204—209).—Studies of oriented silk fibroin fibres with plane-polarised infra-red light show that the C=O bonds are generally perpendicular to the fibre axis. A similar examination of Zn insulinate crystals yields little support for the cyclol hypothesis of insulin structure but favours a configuration of the type $>NH\cdots O{=}C<$.   C. R. H.

Effect of serum-proteins on light absorption by phenol-red in phosphate buffer solution.—See A., 1941, III, 300.

Precise spectrophotometric constants for hæmochromogens and cytochrome c on an iron basis, and analysis of the cytochrome c spectrum. D. L. Drabkin (*J. Opt. Soc. Amer.*, 1941, **31**, 70—72).—Fe in hæmin and cytochrome c (I) can be accurately determined in ~10-mg. samples of 50% (I) by treatment with dil. NaOH and H$_2$O$_2$, conversion of the Fe into its o-phenanthroline complex after reduction with ascorbic acid at p_H 4·2—4·3, and spectrophotometric or photometric comparison of the complex with standard Fe preps. Extinction coeffs. are recorded for (I) and dipyridinoferroporphyrin. Reduced (I) gives absorption max. at $\lambda\lambda$ 5520, 5220, 4150, 3520, 3130, 2735, 2480, and 2240 A.   L. J. J.

Binding between molecules and intramolecular complexes of certain phenols, and the dispersion of absorption bands. M. I. Batuev (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 423—425).—PhOH and its derivatives are very suitable for studying the H bond between mols. and between atoms of the same mol. The band due to OH in the spectrum of o-C$_6$H$_4$Cl·OH is distinguished from that due to OH in PhOH and p-C$_6$H$_4$Cl·OH, as in the o-compound it is possible for a closed ring to exist in consequence of the H bond. o-C$_6$H$_4$Cl·OH exists in a *cis*- and a *trans*-form. The presence of mols. of the latter form is shown by asymmetry of the microphotogram of the OH band.   A. J. M.

Spectrophotometric study of thionine. L. F. Epstein, F. Karush, and E. Rabinowitch (*J. Opt. Soc. Amer.*, 1941, **31**, 77—84).—Data are recorded for the absorption spectra of 4 forms of thionine and 3 forms of leucothionine between 2300 and 9700 A. as a function of concn. Beer's law is followed in solutions containing the free base and tervalent ions. Dimerisation of the univalent ion causes deviations at p_H 2—10.   L. J. J.

Raman spectrum of m-diphenylbenzene. S. K. Mukerji and J. A. Aziz (*Phil. Mag.*, 1941, [vii], **31**, 231—239).—The Raman spectrum of molten m-C$_6$H$_4$Ph$_2$ resembles that of the o-compound (A., 1938, I, 555). With λ 4358 as the exciting line, filtered through conc. NaNO$_2$ solution, the continuous spectrum due to fluorescence is much reduced, and 27 new Raman lines were observed. The most prominent frequency is at 1309 cm.$^{-1}$, and is the characteristic frequency due to the C–C binding of the C$_6$H$_6$ rings. This is also present in Ph$_2$ and in o-C$_6$H$_4$Ph$_2$, but is absent in C$_6$H$_6$. Another strong frequency is at 1597 cm.$^{-1}$, and is due to the C:C linking. The spectrum is discussed in connexion with the spectra of C$_6$H$_6$, Ph$_2$, and o-C$_6$H$_4$Ph$_2$.   A. J. M.

Raman spectra of some ethers containing one or more phenyl groups. M. J. Murray and F. F. Cleveland (*J. Chem. Physics*, 1941, **9**, 129—132).—Raman frequencies and their relative intensities and depolarisation factors are recorded for PhOPr^a, PhOBu^a, CH$_2$Ph·OEt, CH$_2$Ph·OBu^a, and (CH$_2$Ph)$_2$O. Intense frequencies, characteristic of Ph groups, with const. vals. in the series are 618, 1001, 1029, 1156, 1176, 1588, 1604, and 3058 cm.$^{-1}$ The frequency 2911 cm.$^{-1}$, which is strong for the compounds containing Pr or Bu

groups, appears to be more characteristic of the C chain than of the Me group (cf. Fox and Martin, A., 1940, I, 282). The frequencies 440, 900, and 1125 cm.$^{-1}$ may be characteristic of the C–O–C linking.   J. W. S.

Scattering of light and relaxation phenomena in liquids. E. Gross (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 786—791).—The region of continuous spectrum of light scattered by liquids, termed the Rayleigh line background, has been investigated. The causes responsible for it differ from those which give rise to the wings, and it is a phenomenon characteristic of the liquid state. It is quite distinct from the rotational Raman spectrum, and cannot be attributed to free rotation of mols. in the liquid. It is more probably due to changes in orientation of mols. which are optically anisotropic. The effect is considered in relation to Debye's theory of thermal waves, and the conception of a relaxation time is introduced. Theory shows that this should be identical with the relaxation time used by Debye in the theory of dielectric properties of liquids in high-frequency fields. The intensity of the background should depend on the optical anisotropy of the mols., its extent in the spectrogram of the scattered light being determined by η, temp., and size of mols. This is in agreement with experiment. A. J. M.

Constitution of zinc beryllium silicate phosphors. G. R. Fonda (*J. Physical Chem.*, 1941, **45**, 282—288).—Experiments have been carried out to show that the incorporation of Be in the Zn_2SiO_4 lattice is hindered on the one hand by the limitation in the mutual solubility of Be_2SiO_4 and Zn_2SiO_4 as a result of which fluorescence changes are confined to the composition range within which a homogeneous solution exists, and on the other hand by the natural sluggishness of the diffusion of oxides through the silicate layers which surround the reacting particles. The solubility of Be_2SiO_4 in Zn_2SiO_4 is decreased in presence of Mn. The fluorescence intensity of Zn–Be phosphors decreases linearly with increase in Be content until a crit. concn. is reached, after which the intensity falls off irregularly. Fluorescence is essentially a function of the double silicate and is not appreciably affected by the pure Be_2SiO_4 phase which acts more or less as a diluent up to the crit. concn. referred to.   C. R. H.

Behaviour of willemite under electron bombardment. E. R. Piore and G. A. Morton (*J. Appl. Physics*, 1940, **11**, 153—157).—A method of measuring p.d. between a willemite screen under electron bombardment and the accelerating electrode is described. Under scanning bombardment, the screen potential shows local variations of the order of thousands of v., varying with scanning frequency and c.d. The light intensity is $\propto$ a power > 1 of the accelerating voltage.   L. J. J.

Origin of radiation of long and short duration in phosphors with an organic activator. V. L. Levschin and V. N. Tugarinov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 115—119).— The dependence of the intensity of fluorescence I_f and of phosphorescence I_p of a phosphor showing both phenomena on the intensity I_e of exciting radiation is discussed. I_p tends to saturation as I_e is increased. If the same centres are responsible for fluorescence as for phosphorescence, I_f will also tend to saturation with increasing I_e, but if different centres are effective, I_f will continue to increase with I_e after I_p has reached saturation. The variation of I_f and I_p with I_e for uranine–H_3BO_3 phosphors has been measured. At vals. of I_e sufficient to produce saturation in I_p, I_f continues to increase with I_e. It is concluded that different centres are responsible for fluorescence and phosphorescence.
                            O. D. S.

Second-order colours. A. Porai-Koschitz and C. Moerder (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 139—143).— The theory of Strauss and Zeime (A., 1913, i, 992) that the anomalous colour change of dyes, apparent movement of absorption bands to shorter $\lambda\lambda$ on increase of mol. wt. or introduction of a second auxochrome in the *o*- or *p*-position, is due to simultaneous movement to longer $\lambda\lambda$ of two absorption bands (from ultra-violet to visible and from visible to near infra-red respectively) has been tested by an investigation of the infra-red spectrum of some dyes showing such anomalous colour change. No bands in the near infra-red have been observed in the spectra of those compounds in which anomalous colour change has taken place on increase of mol. wt. or introduction of a second auxochrome.
                            O. D. S.

Fluorescence of aqueous solutions of rare earth salts. I. Fluorescence of aqueous solutions of terbium. A. Seidel, J. Larionov, and A. Filippov (*J. Physics, U.S.S.R.*, 1939, **1**, 67—77).—The fluorescence of solutions of Tb sulphate, chloride, and bromide has been investigated. The optimum region of excitation is between 210 and 230 mμ. The fluorescence consists of seven narrow bands of $\lambda\lambda$ 681, 670, 648, 621, 589, 544, and 488 mμ. The wave nos. of the bands agree with the hypothesis that the fluorescence is due to transitions from a single term of the $4f^8$ configuration to all the components of the ground term $^7F_{6, 5, 4, 3, 2, 1, 0}$ of Tb IV. The fluorescence shows an appreciable afterglow lasting > 0.001 sec. The fluorescence may be used for the analytical determination of Tb.   O. D. S.

Spectra of fluorescence and absorption of complex molecules. D. Blochintzev (*J. Physics, U.S.S.R.*, 1939, **1**, 117—124).— Mathematical. The relation between the absorption and the fluorescence spectrum of a complex mol. is investigated. The "law of mirror images" (A., 1931, 1351) would be expected to hold at temp. T for the frequency range E/h, where E is the average mol. energy at temp. T.   O. D. S.

Fluorescence, phosphorescence, and photochemistry of dyes. J. Franck and R. Livingston (*J. Chem. Physics*, 1941, **9**, 184—190).—It is assumed that an electronically excited dye mol. can pass, by internal conversion, to the electronic ground state of a reactive tautomeride, the endothermic reversion of this tautomeride to the electronically excited state of the original mol. explaining the weak, temp.-dependent phosphorescence observed in some systems. Alternatively, in the presence of a reducing agent, the reactive tautomeride may yield a semiquinone. Most dye-sensitised photo-oxidations and the photo-bleaching of dyes by reducing agents can be explained on this theory. The rapid reversible bleaching of chlorophyll can be explained by assuming that the tautomeride and a normal mol. undergo a process of disproportionation.
                            J. W. S.

Possibility of interpreting phenomena of polarised luminescence using linear-oscillator model. VII. V. L. Levschin (*J. Physics, U.S.S.R.*, 1939, **1**, 265—275).—All the experimental data available on polarised luminescence can be satisfactorily interpreted by the aid of a simple linear-oscillator model. Formulæ are deduced expressing polarisation as a function of temp., λ of exciting light, and viscosity of solvent.   A. J. M.

Products of ionisation by electron impact in methyl and ethyl alcohol. C. S. Cummings and W. Bleakney (*Physical Rev.*, 1940, [ii], **58**, 787—792).—Using a special all-metal mass-spectrograph, 14 different ions in MeOH and 25 in EtOH were observed. Appearance potentials and modes of dissociation were in some cases determined. Ionisation potentials were: MeOH 10·8 and EtOH 11·3 v. In each unambiguous interpretation the reaction requiring the least dissociation energy occurred. Results support the concept of localised charge on the O atom in certain complex ions.
                            N. M. B.

Pressure of electronic gas and thermal conductivity of metals. M. Satô (*Sci. Rep. Tôhoku*, 1940, **29**, 304—314).—Theoretical and mathematical. On the assumption that thermal conductivity in metals can be considered to be derived from a pressure gradient of electronic gas, it is shown that conductivity in metals is a similar phenomenon to that in gases and follows the principles enunciated by Sommerfeld, Lorentz, and Einstein.   A. R. P.

Ionic mobilities in insulating liquids. A. Gemant (*Physical Rev.*, 1940, [ii], **58**, 904—908).—Mathematical. A simple method is developed for computing mobilities from conductivity–time curves obtained after application of a d.c. potential. The ionic radii and the concn. of the corresponding particles can be calc. from the mobilities obtained. Application of the method to some available data for mineral oils gives ionic mobilities of $\sim 10^{-7}$ cm. per sec. per v. per cm.
                            N. M. B.

Thermodynamics of irreversible processes. III. Relativistic theory of the simple fluid. II. A correction. C. Eckart (*Physical Rev.*, 1940, [ii], **58**, 919—924, 924; cf. A., 1940, I, 406).—III. Mathematical. Modifications consistent with the special theory of relativity are introduced. The first law of thermodynamics is shown to be a scalar equation, and not the fourth component of the energy–momentum principle. Temp. and entropy are also shown to be scalars.

Simple relativistic generalisations of Fourier's law of heat conduction and of the laws of viscosity are obtained from the requirements of the second law. The accepted relativistic form of Ohm's law is confirmed.

II. A correction (cf. *ibid.*).   N. M. B.

Light effect in chlorine under electrical discharge. S. S. Joshi and V. Narasimhan (*Current Sci.*, 1940, **9**, 535—537).— Two phenomena (A and B) occur with Cl_2 in an electric discharge and to a smaller extent with mixtures of H_2 and Cl_2, and of H_2 and HCl. A refers to the slow diminution with time of the discharge current at a given applied potential; its recovery after discontinuing the current and its "ageing," accelerated by light, show time lags. B is instantaneous and refers to the diminution of current on irradiation. The magnitudes, characteristics, and interpretation of both phenomena are discussed.   W. R. A.

Contact resistance of semi-conductors. B. Davidov (*J. Physics, U.S.S.R.*, 1939, **1**, 167—174).—Mathematical. The space charge at the surface of a semi-conductor due to a contact p.d. between the semi-conductor and the adjacent electrode will produce a change in the concn. of free electrons or, in the case of a semi-conductor with positive-hole conduction, of holes at the surface. The resulting field and contact resistances are calc. If these resistances have the right sign a "barrier-layer effect" will be produced at the surface and will lead to rectification.   O. D. S.

Electrical conductivity of metals. J. Bardeen (*J. Appl. Physics*, 1940, **11**, 88—111).—A survey of current theory.   L. J. J.

Intermolecular sharing of hydrogen. E. B. R. Prideaux (*Chem. and Ind.*, 1941, 145—146).—The physical properties of liquid mixtures of monocarboxylic acids and N bases, and their solutions in C_6H_6, indicate combination without ionisation. This is possible, without 5-covalent N, if a co-ordinate link is formed between the N atom as donor and the acid H atom as acceptor.   F. J. G.

Intermolecular sharing of hydrogen. G. E. Coates (*Chem. and Ind.*, 1941, 185).—The occurrence of divocalent H in liquid salts of piperidine and aliphatic acids (cf. Prideaux, preceding abstract) is considered unlikely; first-order perturbation calculations show that the H^- ion is unstable with respect to H by 39 kg.-cal. per g.-atom. Normal H-bond formation by resonance between $R \cdot CO_2$–H, NH:R and

$R \cdot CO_2$, H–NH:R is possible.   A. J. E. W.

Ferromagnetic domains and the magnetisation curve. W. F. Brown (*J. Appl. Physics*, 1940, **11**, 160—172).—An account of the domain theory of ferromagnetism.
                    O. D. S.

Notation for the derivatives of the two types of line integral in thermodynamics. G. Tunell (*J. Chem. Physics*, 1941, **9**, 191—192).—It is suggested that differentials of functions (*e.g.*, work and heat) which depend on the path through which a system passes should be presented with a subscript indicating the plane in which the line integral is being differentiated, *e.g.*, $(dW/dT)_S$.   J. W. S.

Kinetics of phase change. III. Granulation, phase change, and microstructure. M. Avrami (*J. Chem. Physics*, 1941, **9**, 177—184; cf. A., 1940, I, 122, 223).—Mathematical. The author's theory is generalised and it is shown that a comprehensive description of the phenomena of phase change may be summarised in phase change, grain no., and microstructure formulæ or diagrams, giving the transformed vol., grain, and microstructure densities, respectively, as a function of time, temp., and other variables.   J. W. S.

Theory of van der Waals molecules. R. Heller (*J. Chem. Physics*, 1941, **9**, 154—163).—The mutual potential between two normal state atoms or groups forming a van der Waals mol. can be expressed in the form $V(R) = A e^{-R/\rho} - c_1/R^6 - c_2/R^8 - c_3/R^{10} - c_4/R^{12}$, where A and ρ are positive consts. and R is the variable distance between the centres of positive charge. Using this function, the vibrational wave nos. and energies of dissociation of HgHe, HgNe, HgA, HgKr, HgXe, Hg_2, $(O_2)_2$, and $(NO)_2$ in the normal state are calc. With $\rho = 0.28$ A. satisfactory agreement is obtained with experimental data excepting for $(NO)_2$, in which the binding is probably partly due to first-order attractive forces.
                    J. W. S.

Coriolis perturbations and molecular dimensions in germane, GeH_4. T. Y. Wu (*J. Chem. Physics*, 1941, **9**, 195).—The discrepancy between the observed structure of the ν_4 fundamental of GeH_4 and the structure calc. by Murphy (A., 1940, I, 94) is attributed to the use of a low val. of the moment of inertia (I). Assuming pure valency and deformation forces in the mol., and from the observed val. of $\Delta\nu_3$, the calc. val. of I is 9.77×10^{-40} g.-cm. instead of 7.0 g.-cm. as calc. from $\Delta\nu_3$ and $\Delta\nu_4$. This val. leads to a Ge—H distance 1.49 A., in accord with the Si—H distance in SiH_4.   J. W. S.

Relation between structure and free energy of organic molecules. P. F. Bruins and J. D. Czarnecki (*Ind. Eng. Chem.*, 1941, **33**, 201—203).—The free energy (ΔF°) equation for the formation of a C–H bond is obtained by dividing by 4 the ΔF° equation for the formation of CH_4. From the former equation and the ΔF° equation for the formation of C_8H_{18}, the ΔF° equation for the formation of a C–C bond can be obtained. Continuing the process the ΔF° equations for the formation of C≡C, C–Me, C–OH, C–CHO, and C–CO_2H bonds can be similarly obtained. Unlike equations written in terms of the no. of C atoms, these bond equations can be used in more than one series of hydrocarbons. The equations are sufficiently accurate for most engineering problems.
                    C. R. H.

Surface tension. R. C. Brown (*Physical Soc. Rep. Progr. Physics*, 1940, **7**, 180—194).—A progress report.   W. J.

Surface energy and surface entropy. A. Ferguson and E. J. Irons (*Proc. Physical Soc.*, 1941, **53**, 182—185).—The total molar surface energy ΔE and molar surface entropy ΔS, when defined by $\Delta E = \mu - T\partial\gamma/\partial T$ and $\Delta S = -\partial\mu/\partial T$, where μ is free molar surface energy, are consts. independent of temp., and are connected by T_c. $\Delta S = \Delta E$, where T_c is the crit. temp. ΔE, so defined, is identified with E_0, the zero val. of the molar surface energy of the supercooled liquid. Calc. and experimental data for 23 liquids are tabulated and plotted.   N. M. B.

Nuclear gyromagnetic ratios of the chlorine isotopes. E. F. Shrader, S. Millman, and P. Kusch (*Physical Rev.*, 1940, [ii], **58**, 925).—The mol.-beam magnetic resonance method is applied to LiCl prepared from HCl enriched to ~50% in ^{37}Cl (cf. A., 1940, I, 428), and the resonance min. obtained confirm the previously assigned g vals ^{35}Cl (0·546) and ^{37}Cl (0·454) (cf. A., 1939, I, 590). Assuming 5/2 for the spin of ^{37}Cl, the moment is 1·135 nuclear magnetons.   N. M. B.

III.—CRYSTAL STRUCTURE.

Formation of true X-ray images by reflexion on crystal mirrors. L. von Hámos (*Z. Krist.*, 1939, **101**, 17—29).— The use of a cylindrically bent crystal as a mirror forming real images of X-ray sources is described. The conditions of formation, magnification, and distortion of the image are considered for a point or plane source coplanar with the cylinder axis and the centre of the reflecting surface. The image quality is best when the source is on or near the cylinder axis. The effect of geometrical aberration on the resolving power is relatively small, and may be diminished by reducing the aperture of the mirror, but the chromatic aberration is ~0·1% of the crystal radius, even with typical "monochromatic" X-radiation.   A. J. E. W.

Characteristic elastic vibrations of crystals under mixed boundary conditions. H. Wierzejewski (*Z. Krist.*, 1939, **101**, 94—116).—The Sommerfeld–Ortvay method of determining characteristic vibrations (cf. *Ann. Physik*, 1913, [iv], **42**, 745) is developed by resolution of the vibrations into superposed trains of plane elastic waves. The nature of these waves in an infinite crystal is considered, and the conditions of reflexion are examined for a crystal with a single plane boundary and a cryst. plate. The theory is then extended to crystals of different symmetry types.   A. J. E. W.

Line broadening of deformed metals. U. Dehlinger and A. Kochendörfer (*Z. Krist.*, 1939, **101**, 134—148).—Vals. of the width of the Debye–Scherrer lines of Cu foil of different degrees of rolling (R%) are recorded graphically. The effects of lattice deformations and grain-size ($\Lambda = \sim400$ A. for all R vals.) are resolved; other effects are excluded by the method of measurement (cf. A., 1938, I, 127). Lattice deformations of cosine form, which may vary rapidly with a period of ~2Λ or so slowly that they are sensibly homogeneous within

each particle, cause a continuous displacement of the lines, the max. val., which defines the edges of the line, being $\propto$ the Bragg angle. The separate effects of rapidly and slowly changing deformations can be resolved only by measurements of other properties (*e.g.*, magnetic coercive force). The max. change of lattice const. increases rapidly with R up to $R = 30$ and then more slowly to $\sim 0.2\%$ at $R = 100$, corresponding with a bending amplitude of ~ 0.1Å. The tensions caused by the deformations are ~ 40—50 kg. per sq. mm.

A. J. E. W.

Line broadening by lattice distortions of cosine form. A. Kochendörfer (*Z. Krist.*, 1939, **101**, 149—155; cf. preceding abstract).—The variations of intensity and form of Debye–Scherrer lines due to lattice deformations of cosine form are examined theoretically. The deformations produce a splitting of each line into two symmetrically-disposed components, of which the form and separation are considered for deformation regions of different size ranges. A. J. E. W.

Intensity distribution in Debye–Scherrer lines. F. Lihl (*Z. Krist.*, 1939, **101**, 193—229).—The intensity distribution in monochromatic Debye–Scherrer lines, photographed under given conditions, is discussed in relation to the geometry of the apparatus and absorption in the specimen, the effects of which are specified by a " geometrical factor," G. Formulæ are derived by which the intensities for any diffraction angle can be calc. for a specimen having high or very low absorption; data for a specimen of given absorption coeff. can be derived graphically. Typical intensity distribution curves for single lines are given. A. J. E. W.

Interpretation of Laue photographs in terms of the reciprocal lattice. Correction. C. C. Murdock (*Z. Krist.*, 1939, **101**, 271; cf. A., 1938, I, 500). A. J. E. W.

Diffuse reflexion of X-rays. G. D. Preston (*Nature*, 1941, **147**, 358—359).—The formula derived by Jauncey (A., 1941, I, 102) and the geometrical significance of Faxén's formula are discussed. The physical interpretation of the latter is that the surfaces of const. intensity surrounding the Bragg points are spheres. The pattern given by Al (A., 1939, I, 553) conforms to this rule, and verifies Faxén's formula.

L. S. T.

Crystallographic calculations and constructions with the reciprocal lattice. W. F. de Jong and J. Bouman (*Z. Krist.*, 1939, **101**, 317—336; cf. A., 1938, I, 234, 299, 604, 644; 1939, I, 306; 1940, I, 100).—A detailed account of the properties, construction, and use of the reciprocal lattice, illustrated by typical calculations for babingtonite and gypsum.

A. J. E. W.

Calculation of generalised lattice potentials. G. Molière (*Z. Krist.*, 1939, **101**, 383—388).—Mathematical. A generalisation of Ewald's method (*ibid.*, 1921, **56**, 129), by which generalised Madelung consts. (cf. A., 1939, I, 515) can be calc., is developed. A. J. E. W.

X-Ray study of " crystalline boron." F. Halla and R. Weil (*Z. Krist.*, 1939, **101**, 435—450; cf. A., 1939, I, 185 and Náray-Szabó, A., 1937, I, 16).—A detailed examination of specimens of the " graphite-like " form of AlB_{12}, obtained from pure Al and from reguli containing much Cu, shows the existence of two modifications, for which full morphological and crystallographic data, including reciprocal lattices, are given. From rotation and Weissenberg X-radiograms, the monoclinic modification (I) has $a\ 8.50_5$, $b\ 10.98$ A.; the crystallographic measurements are referred to a face-centred cell with all faces occupied, which has $c\ 9.40$ A., $\beta\ 110°\ 54'$, but the true unit cell, containing 4 mols., has only one face filled, with $c'\ 7.37_8$ A., $\beta'\ 143°\ 29'$, $V\ 410.0$ cu. A.; $\rho\ 2.577$; space-group C_{2h}^3—$C2/m$, C_s^3—Cm, or C_2^3—$C2$. Modification (II) is tetragonal-pseudocubic, with $a\ 10.28$, $c\ 14.30$ A. (tetragonal), or $a\ 14.50$, $c\ 14.30$ A. (pseudocubic); $V\ 1512$ cu. A.; $\rho\ 2.660$; 16 mols. in unit cell; space-group C_4^3—$I4_1$, D_4^4—$P4_12_1$, or D_4^8—$P4_12_1$. Comparison of structural data with analyses shows that the lattice of (II) has a deficit of ~ 12 atoms per 16 mols.; the weaker binding of electrons which form linkings across the gaps causes strong light absorption. The colour of black diamonds may have a similar cause. The region of homogeneity of AlB_{12} extends considerably to the B side of this composition. A. J. E. W.

Oxide phases with a defect oxygen lattice. L. G. Sillén and B. Aurivillius (*Z. Krist.*, 1939, **101**, 483—495; cf. A., 1939, I, 412).—By X-ray analysis, the tetragonal $PbO–Bi_2O_3$ phase (homogeneity range Pb 29—53 at.-% of metal atoms) has $a\ 4.05$—3.96, $c\ 4.90$—5.19 A. (33—53 at.-% Pb); $\rho\ 9.33$—9.29 (33—50 at.-% Pb); 2 metal atoms in unit cell; space-group D_{4h}^7—$P4/nmm$. Rotation and Weissenberg photographs show a superstructure involving a 6-fold increase in a. The metal atom positions, which form a distorted cubic face-centred lattice, are derived by inspection of intensities; the possible O atom positions in the " full " (MO_2) structure are fixed by space-filling considerations, and the parameters confirmed by calc. intensities. The rhombohedral $SrO–Bi_2O_3$ phase (14—26 at.-% Sr) has a primitive cell with $a\ 9.63$—9.80 A., $\alpha\ 23.8$—23.4°, or a triply primitive hexagonal cell with $a\ 3.97$, $c\ 28.06$—28.59 A.; $\rho\ 8.09$—7.45 with 14.6—25 at.-% Sr; 3 metal atoms in unit cell; space-group D_{3d}^5—$R\bar{3}m$. Details of the " full " structure, which has a layer lattice, are given. In both phases the actual O atom positions are obtained by removal of the appropriate no. of O from the " full " structure; the missing atoms appear to be evenly distributed over the possible types of lattice position. The metal atom lattice is the stabilising factor in the structure. The homogeneity limits do not correspond with rational compositions. A. J. E. W.

Crystal structure of strontium bromide. M. A. Kamermans (*Z. Krist.*, 1939, **101**, 406—411).—Three modifications of $SrBr_2$ have been obtained. Evaporation of a solution of anhyd. $SrBr_2$ in EtOH at $>40.5°$ affords needle crystals, for which rotation X-radiograms give a rhombic unit cell, containing 4 mols., with $a\ 9.20$, $b\ 11.43$, $c\ 4.3$ A. (needle axis); $\rho_{calc.}\ 3.65$; $\rho_{obs.}\ \sim 3.8$; space-group $Pbnm$—D_{2h}^{16}. At. parameters derived by inspection of intensities are confirmed by calc. intensity vals. The structure is similar to that of $PbBr_2$. A. J. E. W.

Crystal chemistry of the silicates. I. Náray-Szabó (*J. Hung. Chem. Soc.*, 1940, **1**, No. 3, 1—4).—A review of the development of crystal chemistry in general and of structure of the silicates in particular, with description of theories by Haüy, Bravais, Laue, Goldschmidt, and Bragg. E. V. A.

Crystal structure of Ni_3Ti and Si_2Ti; two new types. F. Laves and H. J. Wallbaum (*Z. Krist.*, 1939, **101**, 78—93; cf. A., 1940, I, 67).—Powder X-radiograms and rotation photographs show that Ni_3Ti has $a\ 5.096$, $c\ 8.304$ A., $c/a\ 1.630$; 4 mols. in unit cell; $\rho\ 7.80$; space-group D_{6h}^4. The structure is a modification of hexagonal close packing such that if $ABAB$. and $ABCABC$. denote the arrangements of layers in true hexagonal and cubic close-packing, respectively, the arrangement in Ni_3Ti is $ABCABAC$ . . Each Ti adjoins 6 Ni in the same layer and 3 Ni in each adjacent layer. Si_2Ti has $a\ 8.236$, $b\ 4.773$, c (pseudohexagonal) 8.523 A.; 8 mols. in unit cell; $\rho\ 4.02$; space-group D_{2h}^{24}. Si_2Ti has a rhombically deformed diamond lattice; each Ti adjoins 6 Si in the same layer, but is in contact with only 2 Si in each adjacent layer. At. parameters and interdistances are tabulated for both structures. The particles in Si_2Ti powder show a strong tendency to assume a preferred orientation, which is prevented by embedding the powder in a synthetic resin. The structures are compared with those of Mg_2Cd, Ni_3Sn, Si_2Mo, and Si_2W. A. J. E. W.

Unit cell and space-group of cæsium cupric chloride. D. P. Mellor (*Z. Krist.*, 1939, **101**, 160—161).—Laue and oscillation photographs show that the orthorhombic unit cell of Cs_2CuCl_4, containing 4 mols., has $a\ 9.69$, $b\ 12.33$, $c\ 7.58$ A.; $\rho\ 3.42$; space-group D_{2h}^{16}—$Pnam$ (or possibly C_{2v}^7). Cs_2CuCl_4 is not strictly isomorphous with $(NMe_4)_2CuCl_4$. The latter has $a\ 12.11$, $b\ 15.50$, $c\ 9.05$ A.; $\rho\ 1.38$; 4 mols. in unit cell; space-group probably D_{2h}^{16}—$Pnam$. A. J. E. W.

Crystal structure of scandium trifluoride. W. Nowacki (*Z. Krist.*, 1939, **101**, 273—283).—Powder X-radiograms show ScF_3 to have $a\ 5.667$, $c\ 7.017$ A., $c/a\ 1.24$ (hexagonal axes), or $a\ 4.022$ A., $\alpha\ 89°\ 34.5'$ (rhombohedral axes) (cf. A., 1939, I, 45); $\rho_{calc.}\ 2.59$; $\rho_{obs.}\ 2.52$. The structure contains 1 Sc at (000) and 3 F at $(\frac{1}{2}x\bar{x}\frac{1}{2}\setminus)$, with $x = 0.025$—0.030. Each Sc is surrounded by 6 F in a slightly deformed octahedral configuration. The F—F distance is now given as 2.72—2.70 A. With slight idealisation the structure corresponds with the idealised WO_3 type; it resembles the structures of FeF_3, CoF_3, RhF_3, and PdF_3 (cf. Wooster, A., 1933, 214) more closely than that of AlF_3. A. J. E. W.

Crystal structure of thallous sulphide, Tl_2S. J. A. A. Ketelaar and E. W. Gorter (*Z. Krist.*, 1939, **101**, 367—375).

—Powder, rotation, and oscillation photographs indicate that Tl_2S has a hexagonal unit cell, containing 27 mols., with a 12·20, c 18·17 A., c/a 1·490; $\rho_{calc.}$ 8·39; $\rho_{obs.}$ 8·40; space-group C_{3i}^4—$R\bar{3}$. Considerations of packing, cleavage, and intensity grouping of the X-ray lines show that the structure, with slight idealisation, is of the layered PbI_2 ($C6$) type; it is closely related to the structure of a-Tl. At. parameters and interdistances, which are in accord with the Goldschmidt at. radii, are tabulated.   A. J. E. W.

Crystal structure of TlSe, thallous thallic or thallosic selenide. J. A. A. Ketelaar, W. H. t'Hart, M. Moerel, and D. Polder (Z. Krist., 1939, 101, 396—405).—From rotation, oscillation, and powder X-radiograms, the tetragonal unit cell of TlSe contains 8 mols. and has a 8·02, c 7·00 A., c/a 0·873; $\rho_{calc.}$ 8·31; $\rho_{obs.}$ 8·175; space-group D_{4h}^{18}. A general study of the observed X-ray intensities gives at. parameters, which are confirmed by calc. intensity vals. The structure shows that TlSe should be formulated $Tl^I[Tl^{III}Se_2]$. The Tl^{III} and Se atoms are covalently linked to form chains of

tetrahedra, $\quad$ Se $\quad$ Se $\quad$ Se
$\qquad$ Tl $\qquad$ Tl $\qquad$ Tl . . . , which lie parallel
$\qquad$ Se $\qquad$ Se $\qquad$ Se

to the c-axis. Each Tl' ion is surrounded by 8 Se. Tl_2Se and TlSe are the only intermediate phases in the system Tl–Se.   A. J. E. W.

Magnetic anisotropy of cupric selenate pentahydrate. A. Mookherji and M. T. Tin (Z. Krist., 1939, 101, 412—417).— Magnetic anisotropy vals. (for method of measurement cf. A., 1937, I, 20) are recorded for different orientations of the crystal. $CuSeO_4,5H_2O$ has nearly uniaxial magnetic symmetry, with the axis parallel to the direction of min. χ. The principal susceptibilities are a 1140, β 1410, γ 1420 $\times 10^{-6}$ c.g.s. units at 28°; the directions of the magnetic axes are determined.   A. J. E. W.

Crystal structure of hydrated potassium chlorostannite. H. Brasseur and A. de Rassenfosse (Z. Krist., 1939, 101, 389—395; cf. Cox et al., 1937, I, 118).—From analysis of oscillation X-radiograms, the orthorhombic unit cell of K_2SnCl_4,H_2O, containing 4 mols., has a 8·21, b 12·05, c 9·10 A.; ρ 2·583; space-group D_{2h}^{16}—Pbnm. Complete at. parameters, derived from a Fourier–Patterson–Harker diagram for $z = 0$, are given. $SnCl_4$" groups do not exist as such in the structure, since each Sn is surrounded by 6 Cl in a nearly regular octahedron; the octahedra share edges parallel to (001) and extend in columns parallel to the c-axis.   A. J. E. W.

Space-group of 1 : 3 : 5-trinitrobenzene crystal. S. L. Chorghade (Z. Krist., 1939, 101, 376—382).—Rotation and oscillation photographs show that the orthorhombic unit cell, containing 16 mols., has a 12·77, b 26·97, c 9·74 A.; ρ 1·69; space-group Q_h^{15} (Pcab). Indexed estimated intensities are given.   A. J. E. W.

Crystal structure of chloranil. S. L. Chorghade (Z. Krist., 1939, 101, 418—424).—From rotation X-radiograms, the monoclinic prismatic crystals of $C_6O_2Cl_4$ have a 8·77, b 5·78, c 17·05 A., β 103·5°; ρ 1·933; 4 mols. in unit cell; space-group $P2_1/a$ (C_{2h}^5). Indexed visually-estimated intensities are tabulated. The structure has pseudo-orthorhombic symmetry with (201) as a plane of symmetry, in accordance with magnetic data (Banerjee, A., 1939, I, 409).

     A. J. E. W.

X-Ray crystallography and chemistry of the steroids. J. D. Bernal, (Miss) D. Crowfoot, and I. Fankuchen (Phil. Trans., 1940, A, 239, 135—182).—The X-ray crystallography of 87 derivatives is surveyed : 38 of the cholesterol series [5 hydrocarbons, 1 monoketone, 8 (OH)$_1$-, 5-polyhydroxy- and keto-compounds, 5 ethers, 6 mono- and 8 poly-halogen derivatives], 14 of the ergosterol series (2 hydrocarbons, 6 mono-, and 4 poly-hydroxy-derivatives, and 2 maleic anhydride adducts), 15 photo-derivatives of ergosterol (6 lumisterol, 7 calciferol, and 2 suprasterol derivatives), and 20 higher plant and animal steroids [13 (OH)$_1$-compounds, 5 acetates, and 2 esters]. The unit cell size, space-group, and data on the morphology and optics have been determined. Patterson projections have been derived from intensities of the X-ray reflexions of the $h0l$ planes for cholesteryl chloride, bromide, and chloride hydrochloride and prove that the mols. are approx. lath-shaped, 20 × 7 × 4 A. Several different crystal structures are encountered and a general geometric classification is attempted which indicates the main groups of monoclinic crystals. The crystallographic data are discussed in

their bearing on sp. chemical problems—characterisation and identification, mol. wt. determinations, stereochemistry of the C skeleton, effect of substituents on the crystallography of the sterols, comparison of the crystallography of different monohydroxy-sterols. Calciferol shows certain differences from the characteristic sterol group and certain similarities which indicate that the actual distribution of atoms in the mol. resembles that in ergosterol.   W. R. A.

X-Ray studies on tuberculin proteins.—See A., 1941, III, 386.

Isomorphism and miscibility of organic compounds. I. Isomorphous replacement of hydrogen, the hydroxyl, amino-, and methyl groups, and chlorine in the crystal lattice of naphthalene. A. Neuhaus (Z. Krist., 1939, 101, 177—192). —Data for 2-$C_{10}H_7X$ (X = OH, NH_2, Me, Cl, respectively) are as follows : a 8·14, 8·60, 7·8, 7·65; b 5·92, 6·00, 5·98, 5·93; c 18·2, 16·75, 18·6, 18·4 A.; β 119° 48', ~115·5°, 103° 16', ~103°; V 761, 782, 844, ~815 cu. A.; $\rho_{calc.}$ 1·249, 1·208, ~1·10, 1·326; $\rho_{obs.}$ 1·245, —, 1·103, 1·266. Certain interplanar distances and morphological, goniometric, and optical data are also given. Among the above compounds and $C_{10}H_8$ the only pair for which true isomorphism is established is 2-$C_{10}H_7$Me and -$C_{10}H_7$Cl, so that the effects of the substituents on the cell dimensions cannot be compared. The structures differ in the angle between the longer mol. axis and the c-axis.   A. J. E. W.

Zinc oxide smoke. G. D. Preston (Nature, 1941, 147, 298). —A photograph, obtained by means of the electron microscope, confirms the finding that some of the particles of ZnO smoke are in the form of needles (cf. A., 1941, I, 104). The small crystals constituting the smoke are ~4500 A. long and $\not>$450 A. thick; the apparent length of the crystals is remarkably uniform.   L. S. T.

Molecular anisotropy of carbamide, and of related compounds. K. Lonsdale (Proc. Roy. Soc., 1941, A, 177, 272— 282).—The magnetic anisotropy of $CO(NH_2)_2$ was measured and compared with that of CO_3" and NO_3'; the relatively large optical anisotropy shows that the NH_2 group is more polarisable than the O ion. X-Ray, magnetic, and optical observations show that carbamide nitrate (I) and oxalate (II), cyanuric acid dihydrate (III), and anhyd. cyanuric acid all crystallise in layer structures; unit cell dimensions were determined. The magnetic anisotropy of (I) and (II) is approx. additive but that of (III) is > the val. for three $CO(NH_2)_2$ mols. It is concluded that although the mols. in each layer must be joined by H bonds the links between successive layers are not necessarily H bonds.   G. D. P.

New method of obtaining the N pattern of electron diffraction. S. Yamaguchi (Nature, 1941, 147, 296).—N patterns are obtained from films prepared by allowing chemical reactions to take place under controlled conditions. A thin film of H_2O or 12n-HCl is first obtained by immersing and withdrawing Pt wire gauze in the solution. Such films are brought into contact with clean K or Ca which give on the gauze films of $KHCO_3$ or $CaCl_2,2H_2O$ suitable for transmission electron diffraction experiments. Patterns for single crystals of these two substances are reproduced; that for $KHCO_3$ gives a 15·4 and b 5·72 A., compared with a_0 15·01 and b_0 5·69 A. given by X-rays.   L. S. T.

Magnetic and other properties of the free electrons in graphite. N. Ganguli and K. S. Krishnan (Proc. Roy. Soc., 1941, A, 177, 168—182).—Graphite crystals have a large free-electron diamagnetism directed almost wholly along the hexagonal axis. In the temp. range 90—1270° k. the diamagnetism per C atom is found to be equal to the Landau diamagnetism of a free electron gas obeying Fermi–Dirac statistics and having a degeneracy temp. of 520° k. It is concluded that there is one free electron per C atom in graphite closely bound to a basal layer but free to migrate in that layer. The result is considered in terms of the Brillouin zones of the graphite crystal.   G. D. P.

Temperature variation of magnetic anisotropy of a bismuth crystal. W. J. John (Z. Krist., 1939, 101, 337—344).—The principal susceptibilities of a 99·998% pure Bi crystal parallel and perpendicular to the trigonal axis are $\chi_{\parallel} = -1·05 \times 10^{-6}$ and $\chi_{\perp} = -1·45 \times 10^{-6}$ at 27°. The anisotropy ($\chi_{\parallel} - \chi_{\perp}$), measured directly by Krishnan and Banerjee's method (A., 1935, 924), decreases linearly with temp. from 0·402 × 10^{-6} at 27° to 0·09 × 10^{-6} at 260°; it then remains approx.

const. up to the m.p., 271·1°. A less pure specimen has $\chi_{||} - \chi_{\perp} = 0.43 - 0.135 \times 10^{-6}$ at 27—260°, with a rapid fall near the m.p., 270°. A. J. E. W.

Magnetic texture and magneto-elastic hysteresis. M. Dechtjar (*J. Physics, U.S.S.R.*, 1939, **1**, 159—166; cf. A., 1939, I, 309).—The change in susceptibility of undeformed crystals of meteorite ferro-nickel Fe (Ni 8, Co 0·5%) after demagnetisation under tension has been investigated. The effect is most marked at low field strengths. Hysteresis curves showing the change in intensity of magnetisation with applied force for normal crystals and for those demagnetised under tension have been obtained and are correlated with the domain theory of ferro-magnetism. O. D. S.

Anisotropy of hysteresis in ferromagnetic single crystals. II. J. S. Schur (*J. Physics, U.S.S.R.*, 1940, **2**, 5—10; cf. A., 1938, I, 182).—The invalidity of previous investigations of the anisotropy of hysteresis in single crystals is demonstrated. The anisotropy of the coercive force (H_c) is measured for a no. of single-cryst. discs of Si steel, cut without mechanical deformation and annealed with magnetic shielding. The results show (*a*) considerable anisotropy of H_c, (*b*) max. and min. vals. of H_c dependent directly on the crystallography of the specimen, and (*c*) that when the magnetic properties of the specimen are made worse the disposition of the max. and min. relative to the crystallographic axes is maintained. In order to obtain commercial ferromagnetics with the smallest hysteresis losses it is considered that (i) the polycryst. material should approach as closely as possible the single-cryst. state, (ii) the texture of the material should be such that in normal working conditions the magnetic field would lie along the direction in which the energy of anisotropy is a min., and (iii) the material should possess large individual grain size. Calc. and experimental vals. of H_e agree satisfactorily (cf. following abstract). W. R. A.

Theory of the technical magnetisation curve in ferromagnetic single crystals. Anisotropy of the coercive force. S. V. Vonsovski (*J. Physics, U.S.S.R.*, 1940, **2**, 11—18).—A general qual. explanation of the anisotropy of the coercive force, H_c, in single-crystal discs of Fe is advanced. A quant. explanation of the anisotropy of min. vals. of H_c is given. Existing experimental data are reviewed and compared with theory. W. R. A.

Energy of magnetic anisotropy and critical field of a ferromagnetic cooled in a magnetic field. S. V. Vonsovski (*J. Physics, U.S.S.R.*, 1940, **2**, 19—23).—The energy of magnetic anisotropy of ferromagnetics cooled in (*a*) " weak " magnetic fields which give rise to the inversion part of the magnetisation curve and (*b*) " strong " fields to which are attributed the part of the curve corresponding with the rotation process have been calc. from existing theoretical data (A., 1938, I, 69). Theoretical expressions for the change in magnetisation work (ΔU) for polycrystals in " strong " and " weak " fields are deduced and for " weak " fields theoretical and experimental vals. of ΔU are approx. equal. The influence of cooling in a magnetic field on the magnitude of the critical field is calc. W. R. A.

Directional dependence of electrical conductivity. E. M. Baroody (*Physical Rev.*, 1940, [ii], **58**, 793—804).—Mathematical. From the theory of conductivity a provisional theory of directional dependence in metallic crystals is developed and applied to simple models. N. M. B.

Crystal structure of Rochelle salt (sodium potassium tartrate tetrahydrate, $NaKC_4H_4O_6,4H_2O$). C. A. Beevers and W. Hughes (*Proc. Roy. Soc.*, 1941, **A**, 177, 251—259; cf. A., 1940, I, 350).—The structure has been determined by Fourier and Patterson analysis. In the tartrate mol. the four C atoms lie in one plane; the remaining atoms are so disposed that each half of the mol. lies in a plane inclined at 60° to the plane of the C atoms. The tartrate mols. are bonded to Na and K atoms both directly and through the medium of H_2O mols. Vals. of the cell parameters are given for the isomorphous NH_4 Na and Rb Na salts. G. D. P.

Properties of Rochelle salt. IV. H. Mueller (*Physical Rev.*, 1940, [ii], **58**, 805—811; cf. A., 1940, I, 433).—A new class of effects, called morphic effects, arising when elastic strains alter the symmetry of crystal structure, is considered. New coeffs., $\propto$ acting strains, introduced into the matrix of the coeffs. characterising the linear effects, give rise to a series of new quadratic effects in crystal physics. The morphic effects are especially large in Rochelle salt crystals, where they are responsible for the so-called Kerr effect and a new type of irreversible piezoelectric effects which has been verified. The new effect creates irreversible normal strains when the crystal is polarised in the *a* direction, and spontaneous contractions occur on cooling below the Curie point. The normal strains are responsible for the anomalous thermal expansion and other anomalies, and also, it is suggested, for the existence of the lower Curie point. N. M. B.

Nature of the anomalies of some properties of Rochelle salt and relation to the polymorphism. R. D. Shulvas-Sorokina (*J. Physics, U.S.S.R.*, 1939, **1**, 299—307).—The part played by the piezo-effect in determining the electro-optical and optical properties of, and the pyro-effect in, Rochelle salt (**I**) is discussed. The Kerr effect can be regarded as having its origin in the piezo-effect, and on this assumption it is possible to explain experimental data on the Kerr effect without recourse to the hypothesis of regions of spontaneous orientation. Crystals of (**I**) are composed of dipoles which are free to rotate. The effect of temp. on the electro-optical properties of the compound is discussed. The electro-optical effect is a max. at the Curie point. A. J. M.

Tribo-electricity in wool and hair. A. J. P. Martin (*Proc. Physical Soc.*, 1941, **53**, 186—189).—When wool fibres (or hairs) are rubbed together, the sign of the tribo-electric charges produced depends on the sense of the rubbing. This effect is due to the cuticle cells of the fibre, which are piezoand pyro-electric. Pyro-electricity is absent or weak in the cortical cells. N. M. B.

Reversal of rectification by heat in crystal contacts and its analogy to a thermoelectric phenomenon. M. A. El Sherbini and Y. L. Yousef (*Proc. Physical Soc.*, 1941, **53**, 120—125). —Using an air-thermostat, experiments on bornite show reversal below 200° for voltages <1 v. There is evidence of a thermoelectric origin for the rectifying action. N. M. B.

Magnetisation of matter by light. F. Ehrenhaft and L. Banet (*Nature*, 1941, **147**, 297; cf. A., 1940, I, 425; 1941, I, 93).—Magnetic poles are induced in non-magnetic and annealed pieces of Fe, placed perpendicularly to the geomagnetic field, by irradiation with ultra-violet light. The poles were mainly north magnetic, and persisted for several days. After short periods of irradiation the effect is local and on the surface; after long periods, saturation vals. are obtained. The characteristic of an induction coil with a Fe core is changed by ultra-violet irradiation. L. S. T.

Distribution of intensity of molecular diffusion of light in a crystal of non-uniform temperature. M. Leontovitsch (*J. Physics, U.S.S.R.*, 1939, **1**, 397—402).—The intensity distribution of the elastic waves of the Debye spectrum of a crystal is calc., and the expression obtained is applied to the determination of the intensity distribution of molecularly diffused light in an infinite cryst. lamina, the faces of which are at different temp. L. J. J.

Diffusion of light in a crystal of non-uniform temperature. G. Landsberg and A. Tschubin (*J. Physics, U.S.S.R.*, 1939, **1**, 403—410).—The intensity–temp. relation for molecularly diffused light in a quartz crystal subjected to a temp. gradient of 80° per cm. differs from that in a uniformly heated crystal by <1%. The lower limit for the decay coeff. of amplitude for ultrasonic waves of frequency 2×10^{10} cycles per sec. is calc. as 0·75 cm.$^{-1}$ L. J. J.

Conical refraction in naphthalene crystals. (Sir) C. V. Raman, V. S. Rajagopalan, and T. M. K. Nedungadi (*Nature*, 1941, **147**, 268).—When suitably cut and mounted, crystals of $C_{10}H_8$ show the phenomena of conical refraction. Photographs are reproduced. Under conditions of perfect focus, the Poggendorf dark circle disappears. L. S. T.

Temperature-dependence of plastic deformation and creep. J. Frenkel (*J. Physics, U.S.S.R.*, 1940, **2**, 49—54).—The Becker–Orowan theory of plastic slip (creep) velocity as a function of temp. is reviewed and an alternative theory, based on the assumption that the limit of elasticity of an ideal crystal lattice is zero, is advanced. A relaxation theory is given of creep, based on the assumption that the crystal lattice is distorted and accordingly hardened by previous slip and re-integrated by gradual return of the dislocated atoms to regular positions. The dynamics of the intermittent creep under small stresses on the basis of an analogy between

velocity-dependence of the limit of elasticity and that of the friction coeff. of two solid surfaces are outlined. W. R. A.

Influence of the temperature of crystallisation on the melting of crystalline rubber. N. Bekkedahl and L. A. Wood (*J. Chem. Physics*, 1941, **9**, 193).—Dilatometric measurements indicate that the melting range of cryst. rubber rises with the temp. (θ) at which crystallisation occurred. For $\theta = 6\text{—}10°$, fusion begins at $\sim4°$ above θ, and this interval increases as θ decreases. J. W. S.

Thermodynamical theory of the tensile strength of isotropic bodies. R. Fürth (*Proc. Roy. Soc.*, 1941, **A**, 177, 217—227). —The tensile strength of an isotropic body is expressed in terms of the elastic consts. and the latent heat of fusion. Good agreement with experimental vals. is obtained.

    G. D. P.

Theory of plastic deformation and twinning. J. Frenkel and T. Kontorova (*J. Physics, U.S.S.R.*, 1939, **1**, 137—149). —Mathematical. The propagation of slip and twinning in crystals is treated as a wave-like motion. For a one-dimensional model, a chain of elastically linked atoms slipping over a fixed chain, two types of wave-like motion can occur : the propagation of small vibrations about equilibrium positions and a slip wave in which the atoms move from one position of equilibrium to another. The slip wave is propagated with a velocity approaching that of sound as its energy is increased and does not occur for energies $<$ a crit. val. W_0. The damping effect due to the motion of the atoms underlying the movable chain is considered and the theory is generalised for the three-dimensional case. For a no. of metals those with high plasticity are found to have low vals. of W_0.

    O. D. S.

Polymorphism of C_{18} unsaturated fatty acids. G. B. Ravitsch, V. A. Volkova, and T. N. Kuzmina (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 88—90).—The existence of a modification of oleic acid with m.p. $19\text{—}20\cdot5°$ is established by heating and cooling curves. This modification is obtained after the acid has been kept at $7\text{—}9°$ for several days.

    F. L. U.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES.

Conductivity measurements on potassium halides. C. G. Brennecke (*J. Appl. Physics*, 1940, **2**, 202—207).—The electrical conductivity κ of flat crystal plates of KBr and KCl has been measured at temp. from $25°$ to $600°$, and potential gradients of $0\cdot05$ to $0\cdot90$ kv. per cm. κ at temp. $<50°$ is reduced by 15—25% after the first heating but then remains const. and unchanged by further heating. Ohm's law is obeyed. At low temp. the current I decays with time t according to $I = kt^{-m}$ where k and m are consts. At high temp. I is const. for all vals. of t. For KBr κ varies with temp. T according to $= Ae^{-BT}$, where A and B are consts. The derived activation energy is $24\cdot5\pm0\cdot5$ kg.-cal. per mol. For KCl the same law is obeyed but the vals. of the consts. A and B change sharply at a transition point at $\sim200°$. The activation energy for the region above the transition point is $45\cdot8\pm0\cdot2$ kg.-cal. per mol. O. D. S.

Absorption of ultrasonic waves in air and in monatomic gases. E. J. Pumper (*J. Physics, U.S.S.R.*, 1939, **1**, 411—430).—Measurements of the absorption coeff. (α) of air, A, and He at $0\cdot1\text{—}1$ atm. pressure, for ultrasonic waves of 379—951·6 kilocycles per sec., are described. Non-uniformity of the ultra-acoustic field causes large deviations from the theoretical relation $\alpha\lambda^2 p = $ const. It is shown how such non-uniformities can be allowed for. For the above gases, at atm. pressure, $\alpha\lambda^2 = 0\cdot00026$, $0\cdot00022$, and $0\cdot00066$, respectively. Existing data of earlier workers are critically reviewed. L. J. J.

Absorption of sound in solids. A. Achieser (*J. Physics, U.S.S.R.*, 1939, **1**, 277—287).—The absorption of sound in dielectrics is considered theoretically. The absorption coeff. is independent of temp. if the latter is high, but at low temp. it is inversely $\propto$ temp. The absorption coeff. is $\propto$ square of frequency in both cases. The effect of thermal conductivity on absorption of sound has also been investigated.

    A. J. M.

Absorption of sound in metals. A. Achieser (*J. Physics, U.S.S.R.*, 1939, **1**, 289—298).—Theoretical. The absorption coeff. of sound in metals is shown to be $\propto$ temp. (T) at high temp., and $\propto T^{-5}$ at low temp. A. J. M.

Velocity of sound in quartz. K. Vulfson (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 792—793).—The velocity of sound in quartz varies considerably with direction, and vals. are given for various directions. The results confirm the hypothesis of Gross that the complex structure of Rayleigh lines is due to the presence of three different acoustic oscillations in an anisotropic crystal. A. J. M.

Sound velocity in liquid mixtures. M. R. Rao (*Current Sci.*, 1940, **9**, 534).—The product of v, the velocity of sound in liquids, and V, the mol. vol., viz., $v^{1/3}V = R$ (A., 1940, I, 104), gives R as a const. independent of temp. R is an additive function of chemical composition. Hence, in a mixture $R_{12} = M_{12}v_{12}{}^{1/3}/\rho_{12}$ (1) where M_{12} is the mean mol. wt. and v_{12} and ρ_{12} are the measured velocity and density, respectively. Also $R_{12} = xR_1 + (1 - x)R_2$ (2), where x is the mol. fraction of one constituent. Agreement between (1) and (2) is very close. A test of both equations is applied to mixtures of BuOH and C_7H_{16}. W. R. A.

Specific heats of copper nitride, niobium nitride, and sodium azide, and the atomic heat of nitrogen. S. Satoh and T. Sogabe (*Sci. Papers Inst. Phys. Chem. Res. Tokyo*, 1941, **38**, 174—182).—The sp. heats of Cu_3N ($0\text{—}99\cdot6°$), NbN ($0\text{—}300°$), and NaN_3 ($0\text{—}99\cdot6°$) have been determined and the at. heat of N has been deduced from the mol. heats of these compounds by subtracting the at. heats of the metals.

    W. R. A.

Latent heats of fusion of some organic refrigerants. J. H. Awbery (*Phil. Mag.*, 1941, [vii], **31**, 247—253).—The latent heats of fusion of MeCl, EtCl, and CCl_2F_2 are 31, 17, and $8\cdot2$ g.-cal. per g., respectively. These vals. are not simply connected with the η or m.p. of the compounds. A. J. M.

Entropy of formic acid. Heat capacity from $15°$ to $300°$ K. Heats of fusion and vaporisation. J. W. Stout and L. H. Fisher (*J. Chem. Physics*, 1941, **9**, 163—168).—The heat capacity of solid and liquid HCO_2H has been measured at $15\text{—}300°$ K. The m.p. is $8\cdot30°$ ($281\cdot40°$ K.) and the heat of fusion is 3031 g.-cal. per g.-mol. At $298\cdot10°$ K. the v.p. is $4\cdot31$ cm. and the latent heat of vaporisation 4754 g.-cal. per g.-mol. Addition of an entropy val. of $0\cdot5R\log_e 2$, due to random orientation of the H-bonds in the solid (Pauling, A., 1936, 275), to the vals. calc. from calorimetric measurements yields vals. of $31\cdot51$ and $47\cdot46$ entropy units per g.-mol. for the entropy of the liquid and saturated vapour, respectively, at $298\cdot10°$ K. J. W. S.

Mathematics and science. G. N. Copley (*Chem. and Ind.*, 1941, 212—213).—A discussion of the significance of mathematical and physical equations in general, mainly in justification of the author's use of van der Waals' equation (cf. A., 1941, I, 78; Evans, *ibid.*, 106). A. J. E. W.

Equations of state. J. A. Beattie and W. H. Stockmayer (*Physical Soc. Rep. Progr. Physics*, 1940, **7**, 195—229).—A progress report. W. J.

Gas imperfection. II. Thermodynamic quantities for some unsaturated aliphatic hydrocarbons derived from the equations of state. E. E. Roper (*J. Physical Chem.*, 1941, **45**, 321—328).—Theoretical. With the aid of previously developed temp. coeff. equations for the second virials of seven unsaturated aliphatic hydrocarbons (A., 1941, I, 35), the second virials (θ), actual mol. vol. (V), temp. coeff. of V, and $C_p - C_v$ have been calc. for the standard state of 1 atm. and $25°$. From v.p. equations and low-pressure data θ, V, fugacities, actual heats and entropies of vaporisation, and gas-imperfection corrections to the heats of vaporisation and abs. entropies have been calc. for the same compounds at their respective b.p. In general, the vals. of all these quantities increase as the mol. structure becomes more complex. The correlation of gas imperfection effects with chain length and g.-mol. wt. is discussed. Imperfection increases somewhat regularly with increase in chain length for a homologous series, but other properties, *e.g.*, dipole moment, polarisability, etc., have considerable influence on the magnitude of the imperfection. C. R. H.

Dissociation treatment of condensing systems. IV. C. Ch'eng, T. P. Tseng, S. K. Feng, and W. Band (*J. Chem. Physics*, 1941, **9**, 123—128).—The more exact theory (A., 1940, I, 18) is applied to 18 gases and the interaction energies per mol. in clusters formed during condensation of the saturated vapours are calc. as functions of temp. From the differences between the surface energy and observed surface

tension the nos. of heavy clusters in the saturated vapour over the liquid are calc. as functions of temp. For 8 vapours the theory predicts appreciable differences between the two crit. temp., that at which the meniscus becomes blurred (T_c) and that at which the densities of the two phases are equal (T_γ). The largest differences are for H_2O (6·5°), MeOH (5·1°), and NH_3 (4·1°). The true crit. vols. at T_γ are calc.   J. W. S.

Activity coefficients of gases. Calculation from the Beattie-Bridgeman equation of state. S. H. Maron and D. Turnbull (*Ind. Eng. Chem.*, 1941, **33**, 69—72).—The Beattie-Bridgeman equation is employed to derive a relation expressing the activity coeffs. (γ) of gases as functions of pressure and temp. This is applied to the calculation of γ for N_2, H_2, and NH_3, the results showing satisfactory agreement with experiment over wide pressure and temp. ranges. The relation can also be used to calculate the equilibrium activity coeff. ratio for the system NH_3-N_2-H_2.   J. W. S.

Generalised equation for activity coefficients of gases. S. H. Maron and D. Turnbull (*Ind. Eng. Chem.*, 1941, **33**, 246—248).—The activity coeff. of a gas (γ) is shown to be a function of the reduced temp. (T_r) and pressure (P_r) only. The equation $\log \gamma = (0.06477/T_r - 0.1706/T_r^2 - 0.04334/T_r^4)P_r + (0.002715/T_r^2 + 0.005165/T_r^3 - 0.0003231/T_r^5)P_r^2 - (0.00002669/T_r^6)P_r^3$ gives vals. of γ which agree with vals. read from Newton's generalised curves (cf. A., 1935, 575) for cases where T_r is $\ll 1.3$ and $P_r \gg 12$. At lower vals. of T_r the agreement is good only when P_r is low.   C. R. H.

Second law of thermodynamics and irreversible processes. P. W. Bridgman (*Physical Rev.*, 1940, [ii], **58**, 845).—A discussion of Eckart's (cf. A., 1940, I, 406) equations for the evaluation of entropy increase when an irreversible process occurs within an isolated system.   N. M. B.

Temperature-dependence of adiabatic compressibility. M. R. Rao (*Nature*, 1941, **147**, 268—269).—The relation $k(\theta_c - \theta) = \sqrt{(V^{1/3}/M\beta_\phi)}$, where k is a const. characteristic of the liquid, θ_c is the crit. temp., V is the molar vol., and β_ϕ is the adiabatic compressibility, holds for C_6H_6, CCl_4, Et_2O, PhCl, PhMe, and AcOH, but not alcohols.   L. S. T.

Structural viscosity in liquids and the derivation of equations for the flux of such liquids through tubes. F. Breazeale (*J. Appl. Physics*, 1940, **2**, 187—192).—For the flux through a tube of a liquid showing no yield val., but possessing structural viscosity, an expression is derived on the hypothesis that above a certain crit. stress the effect of shear on viscosity is not immediately reversible, *i.e.*, that a phenomenon analogous to thixotropy arises. The derived curves agree well in the Bingham region of the flux-pressure with experimental data for a cellulose "solution."   O. D. S.

Viscosities of three classes of liquids. G. N. Copley (*Nature*, 1941, **147**, 207—208).—An approx. linear relationship holds between the vals. of the consts. A and B in the equation $\eta = Ae^{B/RT}$. Ionic, OH-, and non-polar liquids have representative points close to three separate straight lines which appear to have a common origin on the log A–B graph; and $B \sim m(1.65 - \log A)$, where m is a different const. for each of the three classes of liquid. Metallic liquids do not follow this equation.   L. S. T.

Relation of fluidity to volume in organic liquids. E. C. Bingham and P. W. Kinney (*J. Appl. Physics*, 1940, **2**, 192—202).—The Batschinski relation (cf. A., 1913, ii, 928) between the fluidity ϕ and mol. vol. V of a liquid is modified to the form $V = A\phi - B/\phi + C$, where A, B, and C are consts. The equation is applicable to all liquids whether associated or non-associated. The physical meaning of A, B, and C is discussed.   O. D. S.

" Dry friction " forces. S. Chaikin, L. Lissovski, and A. Solomonovitsch (*J. Physics, U.S.S.R.*, 1939, **1**, 455—464).—A dynamic method of measuring tangential and normal forces between surfaces in contact at very small displacements is described. The method depends on the change in shape of the resonance curve of a quartz oscillator produced by contact with another body. At displacements insufficient to cause sliding, Hooke's law is obeyed for displacements up to $\sim 10^{-7} - 10^{-6}$ cm. At greater displacements the force between the surfaces increases more slowly than the displacement. Increase in the pressure between the surfaces increases the deviation from linearity. The limiting angle of friction decreases in the amplitude range where deviation from

Hooke's law is already marked. The deviations occur at comparable displacements and pressures for both normal and tangential displacements.   L. J. J.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

Apparent and partial molal heat capacities and volumes of glycine and glycollamide. II. Concentrated solutions of glycollamide. F. T. Gucker, jun., and W. L. Ford (*J. Physical Chem.*, 1941, **45**, 309—313).—The ρ and sp. heat tables for aq. solutions of $OH \cdot CH_2 \cdot CO \cdot NH_2$ previously published (cf. A., 1939, I, 133) have been extended as a result of determinations with solutions ~ 6.1M.   C. R. H.

Dissolution and diffusion rates in alcohol–water mixtures. E. J. Roehl, C. V. King, and S. Kipness (*J. Amer. Chem. Soc.*, 1941, **62**, 284—287).—Dissolution rates of Mg and Zn in HCl at 25°, and of Mg in AcOH at 15°, 25°, and 35°, and diffusion coeffs. of HCl, AcOH, and KCl at 25° in EtOH–H_2O mixtures have been measured. For HCl the dissolution rate and diffusion coeff. curves initially follow the fluidity curve but at 35% EtOH show marked divergence from the fluidity curve; for AcOH the curves are initially parallel but at 40% EtOH the diffusion curve shows a marked divergence. The mechanism of the dissolution is discussed and it is concluded that the dissolution rate in HCl is controlled almost entirely by a normal diffusion process but in AcOH the rate is partly, if not entirely, controlled by some other than the normal diffusion process.   W. R. A.

Diffusion of water into *n*-butyl alcohol at 30°. M. Randall, B. Longtin, and H. Weber (*J. Physical Chem.*, 1941, **45**, 343—351).—A refractometric investigation of the continuous diffusion of H_2O into $Bu^\alpha OH$ supports the view that the driving force in diffusion is the free-energy gradient rather than the concn. gradient.   C. R. H.

Differential diffusion constant of calcium chloride in aqueous solution. E. A. Hollingshead and A. R. Gordon (*J. Chem. Physics*, 1941, **9**, 152—153).—Using the method described previously (A., 1939, I, 192), the differential diffusion const. (k) of $CaCl_2$ has been determined for concns. of 0·0025—0·5M. at 15—35°. The simple relation between the val. of k at finite concn. and its val. at infinite dilution (A., 1937, I, 459) holds only to 0·01M. For 0·0025M. solutions the mean activation energies for the temp. differences 15—25° and 25—35° are 4·72 and 4·37 kg.-cal., respectively. With increasing concn. the val. falls until at 0·04M. it becomes almost independent of concn. and =4·4 and 4·2 kg.-cal. for these temp. differences, respectively.   J. W. S.

(A) **Diffusion of chromic acid[s] in aqueous solution.** (B) **Diffusion of sodium and potassium chromate and dichromate.** L. W. Öholm (*Finska Kem. Medd.*, 1940, **49**, 9—13, 14—17).—D and η of 0·025—4·0M-CrO_3 and D of Na and K chromate and dichromate (0·1—4·0N.) solutions at 20° have been measured. At high dilution D falls rapidly with increasing concn. and then increases (CrO_3 and $Na_2Cr_2O_7$) or falls more slowly (other salts). D is always higher for the K than for the corresponding Na salt. The results are explained on the basis of dissociation of H_2CrO_4 at low and formation of poly-acids at high concns.   M. H. M. A.

Change of index of refraction with concentration in solutions of water and *n*-butyl alcohol at 30°. B. Longtin, M. Randall, and H. Weber (*J. Physical Chem.*, 1941, **45**, 340—343).—Data for the H_2O-rich and $Bu^\alpha OH$-rich phases of the system $Bu^\alpha OH$-H_2O are recorded.   C. R. H.

Refractive index of electrolytic solutions at low concentrations. R. S. Narayan and B. R. Kulkarni (*J. Osmania Univ.*, 1940, **8**, 25—36).—In sufficiently dil. solutions of $SrCl_2$ and $BaCl_2$, n is a linear function of concn. At higher concn. it becomes a linear function of (concn.)$^{\frac{1}{2}}$.   F. J. G.

Molecular extinction coefficients of dissolved iodine in the photographic infra-red region. T. S. Hsiung (*Sci. Rep. Tsing Hua Univ.*, 1940, **4**, 243—247).—Mol. extinction coeffs. at 4000—10,000 A. are recorded in curves and tables for solutions of I in MeOH, EtOH, C_6H_6, and CCl_4.   F. J. G.

Absorption of ultrasonic waves by electrolytes. P. A. Bashulin (*J. Physics, U.S.S.R.*, 1939, **1**, 431—437).—Absorption measurements are recorded for ultrasonic waves of

4200—37,120 kilocycles per sec. in H_2O solutions of $Zn(OAc)_2$ (0·05—0·15 g.-mol. per l.), $La(NO_3)_3$ (0·1—0·25 g.-mol. per l.), and $Al_2(SO_4)_3$ (0·1 g.-mol. per l.), and in EtOH solutions (0·1 g.-mol. per l.) of $Zn(OAc)_2$ and $La(NO_3)_3$. In all cases deviations from the theoretical quadratic absorption coeff.-frequency relation and from the linear absorption coeff.-concn. relation are found.   L. J. J.

Refractive index of silicate glasses as a function of composition. M. L. Huggins (*J. Opt. Soc. Amer.*, 1940, **30**, 495—504; cf. A., 1940, I, 407).—R_0, the refraction of a glass per g.-atom of O, as defined by the Gladstone–Dale or Newton formulæ, is $= \Sigma a_M N_M$; a_M is a const. characteristic of each constituent element (other than O), and N_M is the no. of atoms of that element per atom of O. This expression has been verified for a wide range of silicate glasses, for which a_M vals. applicable to both types of refraction formula are derived. With glasses containing much Pb the calc. R_0 vals. are too low. Tetrahedrally- and triangularly-surrounded B atoms require different a_M vals. Since the required d vals. can also be calc. (cf. A., 1941, I, 49) n_D for a given glass can be calc. directly from its composition.   A. J. E. W.

Glass melts in the systems zirconia–alumina–silica and titania–alumina–silica. A. E. Badger and L. M. Doney (*Glass Ind.*, 1940, **21**, 309—311, 332).—The chemically pure materials with 3% of B_2O_3 were heated for 1 hr. at 1680° in zircon crucibles. Fusions were also made in the O_2–H_2 flame at >2000°. The clear glass, vitrified and sintered material areas of the fields are shown in triangular diagrams. Thermal expansion measurements made on fibres (apparatus described) give vals. for the ZrO_2 melts of $\sim 2 \times 10^{-6}$ and TiO_2 melts $\sim 4 \times 10^{-6}$. The ZrO_2 and TiO_2 glasses had n as high as 1·625 and 1·650, respectively.   J. A. S.

Bethe–Kirkwood partition function for a binary solid solution. T. S. Chang (*J. Chem. Physics*, 1941, **9**, 169—174).—Mathematical. A symmetrical method of determining the Thiele semi-invariants λ_m in the partition function for a binary solid solution is described. λ_5 and λ_6 are calc.   J. W. S.

Second-neighbour interactions and the critical behaviour of binary solid solutions. T. S. Chang (*J. Chem. Physics*, 1941, **9**, 174—176).—Mathematical. The Thiele semi-variants, γ_1, γ_2, and γ_3 of a binary solid solution are calc. on the assumption that there are second-neighbour, as well as first-neighbour, interactions. The results give a decrease of the crit. temp. (T_c) at which the superlattice sets in, an increase of the local order at T_c, and an increase of the discontinuity of the sp. heat, in general accord with the results obtained by applying Bethe's method.   J. W. S.

Equilibrium solidification of solid solutions. M. Cohen and W. P. Kimball (*Amer. Inst. Min. Met. Eng.*, 1940, *Tech. Publ.* 1256, 2 pp.; *Met. Tech.*, **7**, No. 8).—The composition, δ, of the infinitesimal trace of alloy which transfers from the liquid to the solid state at each temp. during the equilibrium solidification of a binary solid solution $= [Z_L x_L(x_L - P) + Z_S x_S(P - x_S)]/[Z_L(x_L - P) + Z_S(P - x_S)]$, where Z_L and Z_S are the slopes of the liquidus and solidus lines, x_L and x_S are the compositions of liquid and solid stable phases at the given temp., and P is the composition of the alloy under consideration. Calc. δ curves are given for the solidification of five sp. alloys in the Fe–C system.   J. C. C.

Gamma phase of lithium–lead alloys, $Li_{10}Pb_3$; stoicheiometry and structure. M. A. Rollier and E. Arreghini (*Z. Krist.*, 1939, **101**, 470—482).—$Li_{10}Pb_3$, prepared by fusing 44 parts of Pb with 6 parts of Li in an atm. of A, is cubic with a 10·082 A. (from powder X-radiograms); ρ 4·42; 4 mols. in unit cell; space-group T_d^1. The structure, which is confirmed by calc. intensities, is similar to that of γ-brass, and corresponds with the at. arrangement in Cu_9Al_4 (Bradley and Jones, A., 1933, 454). The valency and Hume-Rothery rules are not obeyed in binary Li alloys.   A. J. E. W.

Equilibrium diagram of the system silver–zinc. K. W. Andrews, H. E. Davies, W. Hume-Rothery, and C. R. Oswin (*Proc. Roy. Soc.*, 1941, **A**, **177**, 149—167).—The diagram was investigated by thermal, microscopic, and X-ray methods. The depression of m.p. of Ag by Zn is slightly > that produced by equal at.-% of In. At 50 at.-% of Zn the solidus and liquidus do not coincide; the alloy freezes over a range of $\sim 3 \cdot 5°$. The determination of phase boundaries by X-rays

is found to be unreliable and the limitations of the method are discussed.   G. D. P.

X-Ray study of the solid solubility of lead, bismuth, and gold in magnesium. F. Foote and E. R. Jette (*Amer. Inst. Min. Met. Eng.*, 1940, *Tech. Publ.* 1248, 8 pp.; *Met. Tech.*, **7**, No. 8).—Comparison between the vals. of d measured on annealed filings and those calc. from the lattice consts. indicates that the Pb–Mg and Bi–Mg solid solutions are of the simple substitutional type. The solid-solubility curves have been determined. The solubility of Pb in Mg falls from 39·6% at 468° to 1·8% at 100°, and of Bi from 9·05% at 553° to 0·10% at 250°. The solid solubility of Au has been checked by an indirect method and found to be <0·1 at.-% at 560°.   J. C. C.

Pre-precipitation phenomena in age-hardening alloys. F. W. Jones and P. Leech (*Nature*, 1941, **147**, 327—328).—The sp. heat-temp. curve (reproduced) of an Al–Ag alloy (40% Ag) quenched from 550° and aged for 7 days at room temp. resembles those found with Al–Cu and may be interpreted similarly.   L. S. T.

Concentrated ferromagnetic amalgams. L. F. Bates (*Proc. Physical Soc.*, 1941, **53**, 113—115; cf. A., 1940, I, 351).—Attempts to obtain conc. fluid Ni amalgams are described. An amalgam of 0·091 at.-% of Ni, formed at several temp. below 225°, becomes fluid at lower temp. Conc. amalgams formed by low-temp. distillation become ferromagnetic above 225° at Ni 25 at.-%.   N. M. B.

Structure of intermetallic phases in the system tungsten–cobalt and molybdenum–cobalt. III. M. M. Babitsch, E. N. Kisljakova, and J. S. Umanski (*J. Physics, U.S.S.R.*, 1939, **1**, 309—313).—In the W–Co system, the compound to which the formula WCo was formerly assigned has been proved to be W_6Co_7. It crystallises in the rhombohedral system, with 13 atoms in the unit cell; a 8·98 A., a 31° 19'; space-group D_3^5d—R_3m. In the Mo–Co system, the compound formerly regarded as MoCo has been proved to be Mo_6Co_7. It crystallises in the rhombohedral system; a 8·99 A., a 31° 16'; space-group as above.   A. J. M.

Metallography and certain physical properties of some alloys of cobalt, iron, and titanium. C. R. Austin and C. H. Samans (*Amer. Inst. Min. Met. Eng.*, 1940, *Tech. Publ.* 1257, 11 pp.; *Met. Tech.*, **7**, No. 8).—The quasi-binary equilibrium diagram of the system Co–Fe_2Ti was determined in part by metallographic examination of three alloys quenched from various temp. The solid solubility of Fe_2Ti in the α solid solution varies from $\sim 3\%$ at 500° to $\sim 25\%$ at the eutectic temp. of 1200°. Alloys with ~ 4, 12, and 16% of Fe_2Ti respectively (with 1·5—2·25% of Fe) showed pptn.-hardening when quenched from 950—1300° and subsequently aged at 600—900°. The richer alloys appeared to show strain-hardening effects at 600° and 700°. Creep curves were determined at 600°, 700°, and 800°, using loads of 2000—10,000 lb. per sq. in.; the results suggest that, at 700° and 800°, stress may accelerate the pptn. reactions.   J. C. C.

Solubility of acetylene in blood.—See A., 1941, III, 168.

Solubilities of cupric selenates from 0° to 40°. C. H. Kao and T. L. Chang (*Sci. Rep. Tsing Hua Univ.*, 1940, **4**, 155—158).—Solubility data at 0—40°, and ρ for the saturated solution at 15—25°, are recorded for $CuSeO_4,5H_2O$. Above 40° some hydrolysis, with separation of a basic salt, occurs, but the solid phase in equilibrium with the solution is $CuSeO_4,5H_2O$ up to 80°.   F. J. G.

Samarium selenate and its solubility in water. J. N. Friend (*J.C.S.*, 1941, 112—113).—Solubility data for $Sm_2(SeO_4)_3$ at 17—80° are given. The stable solid phase over this range is $Sm_2(SeO_4)_3,8H_2O$, and this is stable in dry air. The solubility decreases with rise of temp. Separation of Sm and Nd by crystallisation of the selenates is not practicable.   F. J. G.

Solubility product and the solubility of metal sulphides in water. A. F. Kapustinski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 144—147).—The following vals. of solubility products have been calc. from the free energies of formation of the compounds: Bi_2S_3 7·1 × 10^{-61}, Sb_2S_3 2·9 × 10^{-59}, Ag_2S 5·9 × 10^{-52}, Cu_2S 2·6 × 10^{-49}, CuS 3·2 × 10^{-38}, PbS 6·8 × 10^{-29}, CdS 1·2 × 10^{-28}, SnS 1·0 × 10^{-21}, ZnS 7·4 × 10^{-20}, $CoS_α$ 3·1 × 10^{-23}, FeS 3·8 × 10^{-20}, MnS 1·1 × 10^{-15}, MgS 2·0 × 10^{-15}. The solubilities of the sulphides at p_H from 3 to 11

have been calc. from their solubility products by the method of Verhoogen (A., 1938, I, 306).　O. D. S.

Solubility and titration of hæmin and ferrihæmic acid. D. B. Morrison and E. F. Williams, jun. (*J. Biol. Chem.*, 1941, **137**, 461—473).—Ferrihæmic acid requires 2 equivs. of base and hæmin 3 for conversion into a sol. dibasic salt. Absence of a break in titration and solubility curves shows that the two CO_2H groups are approx. equally ionised and dibasic (not monobasic) salts are formed. The overall charge of the ferrihæmate ion is negative. The solubility of ferrihæmic acid is 0·001 g. per l. and of hæmin 0·0009 g. per l.
E. M. W.

Base exchange of the clay mineral montmorillonite for organic cations and its dependence on adsorption due to van der Waals forces. S. B. Hendricks (*J. Physical Chem.*, 1941, **45**, 65—81).—The interplanar spacings of numerous org. salts of clay mineral montmorillonite which have been measured show that the org. cation is held to the surface of the silicate layers by interionic Coulomb forces and by van der Waals attraction of the mols. to the surface. The amount of interplanar spacing depends on the structure of the org. cation and on the way it is adsorbed on the silicate surface. The determination of this spacing (van der Waals " thickness ") enables the structure of mols. to be determined. Fluorene, adenine, and guanine are shown to be planar mols., whilst in guanosine and adenosine the plane of the ribofuranose ring is parallel to that of the guanine or adenine mol. respectively.　C. R. H.

Lyotropic series. III. Adsorption of salts on cellulose. E. Heymann and G. C. McKillop (*J. Physical Chem.*, 1941, **45**, 195—203).—The adsorption of alkali salts by cotton wool decreases in the order $CNS' > I' > IO_3' > Br' > NO_3' > Cl' >$ tartrate $> OAc' > SO_4''$. Alkaline-earth salts are only slightly adsorbed, the order being $Ba'' > Ca'' > Sr'' > Mg''$. The adsorption of $CuCl_2$ and $CuSO_4$ dissolved in NH_3 supports the view that combination takes place between cellulose and Cu-NH_3 complex. The data show that there is a close connexion between the order of adsorption and the usual lyotropic series. For the anions and bivalent cations adsorption is determined mainly by affinity for H_2O, ions with a high energy of hydration being weakly adsorbed. Univalent cations do not follow this rule, a sp. affinity between ion and cellulose outweighing the affinity between ion and H_2O.
C. R. H.

Structure of adsorption layers and form of surface tension isotherms. A. B. Taubman (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 103—107).—Vals. of mol. consts. of saturated adsorption layers, viz., the min. area per mol., the thickness of the layer, and their variations in homologous series have been determined for layers of different classes of substance on H_2O. The results show that s-dibasic acids, their Et esters, and glycols are oriented horizontally. C_5H_5N, all its Me and Me_2 homologues, and nicotine are also oriented horizontally, whilst piperidine and quinoline, in which the highly polar double bonds of C_5H_5N are absent or offset by the less polar C_6H_6 ring, are oriented vertically. An explanation is offered for the inflexion in the surface tension depression-concn. curves observed with certain of the substances studied.　F. L. U.

Surface tension of solutions of electrolytes as a function of concentration. II. G. Jones and W. A. Ray (*J. Amer. Chem. Soc.*, 1941, **62**, 288—294; cf. A., 1937, I, 446).—The relative surface tensions (γ) of aq. solutions of $BaCl_2$, $SaCl_2$, $KClO_3$, $KCNS$, $K_3Fe(CN)_6$, $K_4Fe(CN)_6$, CsI, and LiF have been measured at 25° over the concn. range 0—5N. at 25°. A decrease in γ at approx. 0·001N. was observed, which is in agreement with previous data for KCl, K_2SO_4, and $CsNO_3$, and suggests that all salts are " capillary-active " in sufficiently dil. solution. With increasing concn. γ increases, the salts becoming " capillary-inactive." The theoretical significance of the results is discussed and the validity of the Onsager-Samaras and Dole equations for the variation of γ with concn. is considered.　W. R. A.

Change with time of surface tension of sodium laurate solutions. G. C. Nutting and F. A. Long (*J. Amer. Chem. Soc.*, 1941, **62**, 84—88).—The decrease with time of γ of aq. solutions of Na laurate at 25° between 0·001N. and 0·07N. and at p_H 7—11 has been measured using the sessile bubble method. At p_H 11 and concns. < the crit. concn. for micelle formation γ decreases gradually for several hr., the equilibrium γ de-

pending on concn. In solutions of micellar concn. the time effect practically disappears. With decreasing p_H the equilibrium γ and time effect diminish markedly and this is probably due to closer packing of fatty acid mols. than of ions in the surface film and the more rapid diffusion of nonionised mols. into the surface region.　W. R. A.

Demonstration of " wetter " water. C. R. Caryl (*J. Chem. Educ.*, 1940, **17**, 468).—The addition of a few drops of conc. Aerosol O.T. causes powdered S, string, cotton, or wool to sink immediately in H_2O.　L. S. T.

Motion of a mercury index in a capillary tube. M. A. Abbasi and S. M. Ali (*J. Osmania Univ.*, 1940, **8**, 37—60).　F. J. G.

Measuring the effective areas of film-forming molecules. N. F. Miller (*J. Physical Chem.*, 1941, **45**, 289—299).—A rapid method for measuring the effective areas of polar mols. is based on the equilibrium of tensions established at the point where the pressure developed in the deposited monolayer has become large enough to prevent the spreading of a lens of solution on the substrate. When C_6H_6 solutions of polar substances (0·5—2 × 10^{-6} g.-mol. per c.c.) are deposited on a substrate, the first stable lens is formed when the substrate is covered with a monolayer at a film pressure of 10·3±0·3 dynes per cm. Further addition of C_6H_6 solution develops higher film pressures accompanied by an increase in the lens angle. The technique of the method is fully dealt with and six criteria are given for distinguishing the equilibrium lens from lenses immediately preceding it. The theory of the method is discussed.　C. R. H.

True surface densities of protein films. A. Norris (*Nature*, 1941, **147**, 358).—Data for the spreading of zein and of hen ovalbumin on 0·01N-H_2SO_4 at room temp. are recorded, and discussed in relation to initial uneven spreading and to contamination of the films on keeping.　L. S. T.

" Surface elasticity " of protein films. II. Properties of partially and completely spread films. J. B. Bateman and L. A. Chambers (*J. Physical Chem.*, 1941, **45**, 209—222).—Data previously obtained (cf. A., 1939, I, 316) for the spread of ovalbumin films on H_2O have been extended in order to study the variations of max. surface elasticity, M_m, over a wider range of vals. for the measured limiting area, A_0. Variations of p_H of the substrate can produce a ten-fold variation in A_0 without much change in M_m. With increasing p_H, M_m decreases slightly whereas A_0 shows a pronounced max. at the isoelectric point. Much of the data can be explained if it be assumed that A_0 differs from the true limiting area Λ_0. The ratio A_0/Λ_0 may vary widely for a given substrate. There is no way of determining Λ_0 and until this is possible the observed effect of p_H on M_m has limited theoretical val. The data are discussed with reference to theories of film structure.　C. R. H.

Compressed films at solid–liquid interfaces. J. L. Culbertson and L. L. Winter (*J. Amer. Chem. Soc.*, 1941, **62**, 95—97).—The unfrozen H_2O on wetted SiO_2 gel and C surfaces has been determined from 0° to −50° by the calorimeter method. Assuming the sp. areas of the solids to be comparable it was found that SiO_2 binds H_2O more strongly than does C.
W. R. A.

Properties of multimolecular layers of non-aqueous liquids. M. Kusakov and A. Titievskaja (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 332—335).—Capillary pressure (P)-film thickness (h) isotherms have been obtained for films of n-paraffins between a bubble and a solid surface. For a given P, h is a max. for C_8–C_9. For different surfaces, h increases in the order quartz < diamond < Pb glass < steel. Addition of fatty acids increases h, but H_2O has no effect.
L. J. J.

Permeability of membranes. VI. Passage of an electric current across selective membranes. K. H. Meyer and W. Straus (*Helv. Chim. Acta*, 1940, **23**, 795—800; cf. A., 1937, I, 408).—When a current of 0·75 ma. is passed across a composite membrane consisting of 4 membranes permeable to cations and 3 permeable to anions (selectivity consts. 0·02 and 0·017 respectively), arranged alternately and immersed in 0·01N-KCl, a polarisation e.m.f. of 100 mv. is obtained 20 sec. after interrupting the current. This e.m.f. decreases rapidly and approaches zero after 30 min.　F. L. U.

Dielectric properties of protein solutions. III. Lactoglobulin. J. D. Ferry and J. L. Oncley (*J. Amer. Chem. Soc.*, 1941, **63**, 272—278; cf. A., 1938, I, 357).—Dielectric consts.

of solutions of lactoglobulin (I) in 0·25M- and 0·50M-glycine have been measured at 0° and 25° over a frequency range of 10^4—5×10^6 cycles per sec. and the dielectric increments per g. per l. have been determined. The dipole moment of (I) is 730 D. at 25° and 770 D. at 0°. Dispersion curves are compared with those from η, diffusion, and ultracentrifuge measurements. All data are interpretable by postulating an elongated, ellipsoidal mol., having $a/b = 4$ and 0·3 g. of H_2O of hydration per g. of (I).   W. R. A.

Experiments on thixotropic and other anomalous fluids with a new rotation viscometer. J. Pryce-Jones (*J. Sci. Instr.*, 1941, **18**, 39—48).—The viscometer consists, in principle, of two identical Couette viscometers rotating in opposite directions. Its use in the study of anomalous η, thixotropy, dilatancy, elastic recoil, yield val., and the degree of dispersion of suspensions of solids in liquids is described. The author criticises the rather loose meanings assigned by many writers to certain rheological terms and illustrates the true meanings of these terms.   C. R. H.

Chlorophyll. III. Cataphoresis and electrolytic coagulation of colloidal chlorophyll. M. A. R. Khan and M. Qureshi (*J. Osmania Univ.*, 1940, **8**, 1—5).—In chlorophyll hydrosols the particles are negatively charged. The concns. of KCl, $MgCl_2$, and $AlCl_3$, respectively, required for flocculation are as 2000 : 100 : 1.   F. J. G.

VI.—KINETIC THEORY. THERMODYNAMICS.

Sorting of mixed solvents by ions. G. Scatchard (*J. Chem. Physics*, 1941, **9**, 34—41).—By application of the method of Debye and McAulay (A., 1925, ii, 171), the electrostatic interaction of ions with non-electrolytes is calc. for $EtOH$–H_2O mixtures, and an approx. relation, which can be extended to other solvents, is derived. Agreement with experiment is unsatisfactory, probably owing to neglect of the discrete structure of the solvent.   J. W. S.

Fourth ionisation constant of ferrocyanic acid. O. E. Lanford and S. J. Kiehl (*J. Physical Chem.*, 1941, **45**, 300—304).—Measurement of $H^{\bullet}$ activity in solutions of $K_4Fe(CN)_6$ or $Na_4Fe(CN)_6$ and HCl gives the val. $6 \cdot 8 \times 10^{-5}$ for the fourth ionisation const. of $H_4Fe(CN)_6$.   C. R. H.

Physico-chemical studies of the simpler polypeptides. I. Dissociation constants of glycine, mono-, di-, tri-, tetra-, penta-, and hexa-glycylglycine and their esters. S. Glasstone and E. F. Hammel, jun. (*J. Amer. Chem. Soc.*, 1941, **62**, 243—248).—The dissociation consts. of glycine, mono-, di-, tri-, tetra (I)-, penta- (II), and hexa-glycylglycine (III), of the Et ester hydrochlorides of the first four, and of the Me ester hydrochloride of (II) have been determined at 20° by potentiometric titration using the glass electrode. The results agree with the concept of a freely rotating chain of increasing length up to and including (I). The sudden increase in dissociation const. of $+NH_3 \cdot RCO_2^-$ at (II) combined with the low dielectric increment (cf. A., 1933, 459) suggests that in (II) and (III) there is a restriction to free movement in the $+NH_3 \cdot R \cdot CO_2^-$ form which does not exist in $NH_2 \cdot R \cdot CO_2^-$. Measurements for $+NH_3 \cdot R \cdot CO_2H$ indicate that in (II) and (III) it has the same structure as $+NH_3 \cdot R \cdot CO_2^-$.   W. R. A.

Graphical correlation between p_H values, molarities, and dissociation constants of weak acids. N. Porges and T. F. Clark (*J. Chem. Educ.*, 1940, **17**, 571—573).—Curves for HCl, $H_2C_2O_4$, HCO_2H, $AcOH$, H_2CO_3, H_3BO_3, $PhOH$, $PrCO_2H$, fumaric, citric, gluconic, and lactic acids, and glucose are reproduced, and their applications discussed.   L. S. T.

Acid strength of bile acids. W. D. Kumler and I. F. Halverstadt (*J. Biol. Chem.*, 1941, **137**, 765—770).—The dissociation consts. for lithocholic, cholic, dehydrocholic, and other bile acids lie within the range $pK_a = 6 \cdot 10$—$6 \cdot 20$ in 50 vol.-% $EtOH$–H_2O and are almost identical with that for n-$C_5H_{11} \cdot CO_2H$. They are higher in pure H_2O.   P. G. M.

Liquid ammonia as a solvent. IX. Activity coefficient of potassium iodate at 25°. V. J. Anhorn and H. Hunt (*J. Physical Chem.*, 1941, **45**, 351—362).—The activity product of KIO_3 in liquid NH_3 at infinite dilution has been determined from solubility measurements in presence of KCl, KBr, KI, NaCl, and NH_4Cl. Deviations from the limiting Debye–Hückel theory are ascribed to the low dielectric const. for

liquid NH_3 as a result of which the ions of the two electrolytes affect each other owing rather to the electrostatic forces between them than to the effect of their electric fields on the NH_3 mols.   C. R. H.

Thermodynamic study of the system zinc sulphate–sulphuric acid–water at 25°. H. V. Tartar, W. W. Newschwander, and A. T. Ness (*J. Amer. Chem. Soc.*, 1941, **63**, 28—36).—Thermodynamic activities (a) of H_2O, $ZnSO_4$, and H_2SO_4 have been determined independently at 25° in solutions varying from 0·1 to 4·0M. with respect to H_2SO_4 and 0·5 to 2·0M. with respect to $ZnSO_4$. For H_2O a was determined from v.p. measurements; for H_2SO_4 a was obtained from the e.m.f. of cells of the type $H_2|H_2SO_4(m_1)$, $ZnSO_4(m_2)|Hg_2SO_4|Hg$. The e.m.f. of cells of the type Zn–Hg (one phase)| $H_2SO_4(m_1)$, $ZnSO_4(m_2)|Hg_2SO_4|Hg$ were measured and from these vals. the e.m.f. of cells $Zn|H_2SO_4(m_1)$, $ZnSO_4(m_2)|$ $Hg_2SO_4|Hg$ were calc. and from these calc. e.m.f. vals. a for $ZnSO_4$ was computed. The vals. for ΔG and ΔH for the reaction $ZnSO_4 + H_2O \rightarrow Zn + H_2SO_4 + \tfrac{1}{2}O_2$ have been calc. for a series of solutions. The energy efficiency of the electrolytic Zn process is discussed. An improved type of dynamic v.p. apparatus is described.   W. R. A.

Osmotic and activity coefficients of tervalent chlorides in aqueous solution at 25°. C. M. Mason (*J. Amer. Chem. Soc.*, 1941, **63**, 220—223).—Isotonic ratios and osmotic coeffs. have been determined at 25° for aq. $SmCl_3$ and $EuCl_3$. A new method, based on Debye's theory, of smoothing osmotic coeffs. is described. Activity coeffs. have been calc. by the new method for aq. $AlCl_3$, $ScCl_3$, YCl_3, $LaCl_3$, $CeCl_3$, $PrCl_3$, $NdCl_3$, $SmCl_3$, and $EuCl_3$.   W. R. A.

X-Ray diffraction studies in the system CuO–Fe_2O_3. W. O. Milligan and J. Holmes (*J. Amer. Chem. Soc.*, 1941, **63**, 149—150).—From X-radiograms it is concluded (i) that mixtures of CuO and Fe_2O_3, pptd. at 25° and air-dried, contain no Cu^{II} ferrite, $CuFe_2O_4$, (ii) that refluxing the samples with H_2O for 24 hr. at 100° induces no formation of $CuFe_2O_4$, and (iii) that heating to 1000° for 1 hr. followed by quenching in cold H_2O and air-drying yields cryst. $CuFe_2O_4$. These data agree completely with those of Holgersson (A., 1929, 1131) and of Wartmann and Thompson (A., 1935, 312) but are in contrast with the results of Forestier and Lonquet (A., 1939, I, 482).   W. R. A.

Liquid-crystalline, waxy, and crystalline phases in binary mixtures of pure anhydrous soaps. M. J. Vold (*J. Amer. Chem. Soc.*, 1941, **62**, 160—168).—The stable phases of a Na salt of a n-fatty acid that can occur between room temp. and melted liquid temp. are cryst. (of which there is more than one kind), subwaxy, waxy, superwaxy, subneat, neat, and ordinary liquid. For Na palmitate (I), using a hot-wire technique, five of these phases have been observed and transition temp. determined. Portions of phase-rule diagrams for anhyd. binary mixtures of (I) with Na stearate (II), laurate (III), and behenate (IV), and of (II) with (III) and Na oleate (V), have been determined and the identity of some of the equiv. forms of the different soaps established. The anhyd. neat soap form found in (II) is absent in (IV) and (V). The so-called superwaxy phase is recorded for the first time.   W. R. A.

Stable phases occurring between true crystal and true liquid for single pure anhydrous soaps. M. J. Vold, M. Macomber, and R. D. Vold (*J. Amer. Chem. Soc.*, 1941, **62**, 168—175; cf. preceding abstract).—Dilatometric and microscopic study has been made of transition temp. between successive stable forms of all members of the homologous series of Na salts of n-fatty acids containing an even no. of C atoms from C_6 to C_{22}, and of Na cerotate and oleate and K stearate (I). For the entire sequence of Na soaps examined behaviour similar to that of Na palmitate has been observed but the no. of intermediate forms is not the same for each soap. The regularity of the curves of transition temp. against chain length, and similarities in vol. change, visual and microscopic appearance, suggest a similar mol. arrangement in corresponding phases of C_{14} to C_{22}, and possibly of C_{12}. In two instances curves of transition temp. against chain length run together and give rise to a change in the no. of stable phases intervening between the normal cryst. and isotropic liquid forms. With (I) a similar but probably not identical sequence was found. Measurements using a hot-wire technique were in accord with dilatometric observations. The relationship between transition temp. and chain length is briefly discussed.   W. R. A.

System nitromethane–*n*-propyl alcohol–water. Vapour-liquid equilibria in the ternary and the three binary systems. A. R. Fowler and H. Hunt (*Ind. Eng. Chem.*, 1941, **33**, 90—95).—The system $MeNO_2$–$Pr^{a}OH$ has been investigated at 25°, analysis being carried out by *d* and *n* measurements on the liquid and condensed vapour phases. The solubility equilibria are shown in a graph, whilst the compositions of various binary and ternary mixtures and of the vapours in equilibrium with them are shown in graphs and tables. A ternary azeotrope with min. b.p. (82·3°) contains $MeNO_2$ 55·9 and $Pr^{a}OH$ 26·6%. This azeotrope could be used to separate $MeNO_2$ from a large vol. of H_2O and $Pr^{a}OH$.   J. W. S.

System sodium bromide–hydrogen bromide–water. S. J. O'Brien, C. L. Kenny, and R. J. Fuxa (*J. Chem. Educ.*, 1940, **17**, 576—577).—Apparatus and procedure for determining the phase diagram for this system are described.   L. S. T.

25° isotherm of the systems CaO–B_2O_3–H_2O and MgO–B_2O_3–H_2O. A. V. Nikolaev and A. G. Tschelischtscheva (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 127—130).—Compounds $CaO,B_2O_3,6H_2O$ (**I**), $2CaO,3B_2O_3,13H_2O$ (**II**) (inyoite), and $CaO,3B_2O_3,4H_2O$ (**III**) are formed. Refractive indices are respectively : (**I**) n_g 1·512, n_p 1·504, crystals biaxial, negative, hexahedral prisms, and (**III**) n_g 1·550, n_p 1·505. *n* of (**II**) are equal to those of natural inyoite. Compounds $2MgO,3B_2O_3,15H_2O$ (**IV**) (inderite), the diborate $MgO,2B_2O_3,9H_2O$ (**V**), and triborate $MgO,3B_2O_3,7·5H_2O$ (**VI**) are formed. *n* of (**IV**) are equal to those of natural inderite. For (**V**) n_m 1·485, n_p 1·442, crystals rounded, uniaxial, negative, hexagonal. For (**VI**) n_g 1·508, n_p 1·463, crystals uniaxial, negative.   O. D. S.

Heats of organic reactions. X. Heats of bromination of cyclic olefines. M. W. Lister (*J. Amer. Chem. Soc.*, 1941, **63**, 143—149).—Heats of bromination of olefines in CCl_4 by Br have been measured by a vac. calorimeter (described). V.p. of olefines and their dibromides have been measured over a range of temp. Hence heats of vaporisation and of bromination at 27° have been calc. and are, respectively : *cyclo*-pentene, 6780, 28,610; -hexene, 7789, 33,630; -heptene, 8779, 30,440; -octene, 9936, 29,310; Δ^{a}-heptene, 8587, 30,240; Δ^{a}-butene, —, 28,900 g.-cal. No satisfactory explanation of observed data can be advanced but the existence of repulsive forces between non-bonded adjacent atoms is favoured rather than attractive forces. W. R. A.

Calorimetric investigations of organic reactions. III. Heats of ionisation of glycine at 25°. J. M. Sturtevant (*J. Amer. Chem. Soc.*, 1941, **63**, 88—93).—Heats of neutralisation of glycine by HCl and NaOH have been measured calorimetrically at 25° and from these the heats of ionisation, respectively 930 and 2771 g.-cal. per mol., have been calc. and are in good agreement with existing data. W. R. A.

Heat of mixing of chloroform with polyamines. R. W. Spence (*J. Physical Chem.*, 1941, **45**, 304—309).—The max. vals. for the heat of mixing, *H*, of $CHCl_3$ with *cyclo*hexylamine (**I**), NH_2Bu, $(CH_2·NH_2)_2$, diethylenetriamine, and triethylenetetramine are 800, 700, 440, 640, and 800 g.-cal. per mol. of solution respectively. For the first two compounds *H* occurs at 0·5 mol. fraction of $CHCl_3$, and for the remainder it occurs at 0·6 mol. fraction of $CHCl_3$. The drop in *H* in going from (**I**) to the polyamines suggests that the latter are associated through N–H←N bonds. On mixing with $CHCl_3$ energy is liberated when C–H←N bonds are formed and energy is used in breaking N–H←N bonds, the resulting *H* being < it would be if the polyamine was unassociated. It is not possible to decide from the position of the max. in the *H* curves how many N atoms in the polyamines are available for bonding. C. R. H.

Heat of wetting of wood charcoal by some common liquids. R. I. Razouk (*J. Physical Chem.*, 1941, **45**, 179—189).—An ampoule containing charcoal was evacuated at 300° for 6 hr. and then sealed. It was then broken under various liquids and the heat change resulting from the wetting of the C was measured. H_2O, aliphatic alcohols, C_6H_6, C_5H_5N, and CCl_4 were investigated. With H_2O and MeOH the heat of wetting (*H*) is developed within a few min., but with other liquids the time is appreciable and increases in the order EtOH, $Pr^{a}OH$, $Bu^{a}OH$, $Pr^{\beta}OH$, C_5H_5N, reaching ~30 min. in the case of C_6H_6. *H* depends not only on the surface area of the C but on its nature and the manner in which it has been treated. The data afford strong support for the explanation of *H* in

terms of free energy changes at the C surface and their temp. coeffs. as measured by the expansion of C on immersion in the liquids.   C. R. H.

Heat of wetting of partially saturated charcoal. R. I. Razouk (*J. Physical Chem.*, 1941, **45**, 190—194; cf. preceding abstract).—The heat developed when charcoal containing known amounts of MeOH is immersed in MeOH has been measured. The differential heat of wetting is const. and equals the calc. net heat of adsorption for the later stages of adsorption. If the C is initially saturated with MeOH no measurable heat is evolved on immersion in MeOH. This is unexpected but it is possible that the slow rate at which heat is evolved renders its detection and measurement difficult.   C. R. H.

VII.—ELECTROCHEMISTRY.

Conductivity of calcium salts. A. S. Jensen and M. R. Unangst (*J. Chem. Physics*, 1941, **9**, 195).—The conductivities of 0·1, 0·01, and 0·001N. solutions of Ca gluconate (**I**), benzoate, lactate, lævulate, and salicylate, $CaCl_2$, and $CaBr_2$ at 18° are given. Additional data for solutions of (**I**) at 18° and 25° are also recorded.   J. W. S.

Flow potentials through metals. W. G. Eversole and D. L. Deardorff (*J. Physical Chem.*, 1941, **45**, 236—241).—Theoretical. A general equation permitting the calculation of the p.d. set up by liquid flow through a small hole in a metal disc has been derived. Certain special forms of the general equation are considered.   C. R. H.

Overvoltage and the structure of the electrical double layer at a hydrogen electrode. G. E. Kimball, S. Glasstone, and A. Glassner (*J. Chem. Physics*, 1941, **9**, 91—96).—Application of the theory of abs. reaction rates to electrodes leads to a function for the sp. rate of discharge of ions involving a potential, which, by application of experimental data, is shown to be the overvoltage, whereas the theory requires it to be the total potential. This anomaly is explained by postulating the existence of two different electrical double layers, with corresponding energy barriers, at the electrode surface. If the barrier nearer the electrode is the higher, the overvoltage is essentially established across this layer, whilst the variation in equilibrium potential caused by variations in the [H'] of the solution is established across the outer double layer. Since the rate of discharge is determined by the p.d. across the inner double layer it follows that it is determined by the overvoltage and not by the total potential. Both barriers may correspond with proton transfer from one H_2O mol. to another or, less probably, may correspond with the discharge process in which a H atom is formed.   J. W. S.

VIII.—REACTIONS.

Physics of flames and explosions in gases. (A) W. T. David. (B) B. Lewis and G. von Elbe (*J. Appl. Physics*, 1940, **11**, 157—158, 158).—(A) Attention is directed to the author's views on "latent energy" (cf. *e.g.*, A., 1941, I, 117). (B) A rejoinder to the above.   L. J. J.

Reaction between hydrogen and oxygen : the upper explosion limit and the reaction in its vicinity. G. von Elbe and B. Lewis (*J. Chem. Physics*, 1941, **9**, 194—195).—The upper explosion limit of H_2–O_2 mixtures is decreased considerably by the presence of H_2O vapour. The effect is similar to that of other gases (cf. Grant and Hinshelwood, A., 1933, 909). When the explosion is approached from the high-pressure side short bursts of reaction, dying out rapidly, are observed. This is due to the lowering of the explosion limit by the H_2O formed. Above the upper explosion limit the reaction rate passes through a min. with increasing pressure. The upper limit of explosion at 400—570° is > that found previously (Thompson and Hinshelwood, A., 1929, 403); the low results can be explained by the H_2O-vapour effect. The results also explain the anomalies observed by Oldenberg and Sommers (A., 1940, I, 363).   J. W. S.

Thermal reaction between hydrogen and oxygen. II. Third explosion limit. O. Oldenberg and H. S. Sommers, jun. (*J. Chem. Physics*, 1941, **9**, 114—117; cf. A., 1939, I, 325).—The thermal high-pressure explosion of a H_2–O_2 mixture ("third explosion limit") occurring near atm. pressure at

560° has been studied and the upper section of the limiting curve in the p–T diagram has been determined. In accord with previous observation (A., 1931, 320) coating the surface of Pyrex vessels with KCl makes the reaction slower and more reproducible. The results, however, do not decide between different theories of the reaction.   J. W. S.

Kinetics of reactions in solution. S. V. Anantakrishnan (*J. Annamalai Univ.*, 1940, **10**, 81—104).—A review including collision activation, the transition state, the kinetics of nitration of aromatic compounds, addition of Br_2 and HBr to olefines, mol. rearrangements, onium degradation, and ester hydrolysis.   A. J. E. W.

Rate of hydration of isomeric platino-complexes. M. M. Jakschin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 329—331).—The rates of hydration of isomeric $K_2[Pt(S_2O_3)_2]$ to $K_2H[Pt(OH)(S_2O_3)_2]$ in dil. aq. solution have been compared by following the change of mol. conductivity with time. The change is much more rapid in the case of the more sol. isomeride, which is concluded to be the *cis*-form.   L. J. J.

Hydrodynamic problems relating to the processes of combustion and gasification of a layer of combustible solid. B. Kantorovitsch (*Compt. rend. Acad. Sci., U.R.S.S.*, 1940, **28**, 244—249).—The velocity of reaction between a gas and a solid surface over which it is passing is discussed theoretically, and expressions are derived for the vals. of the apparent velocity coeffs. in various circumstances.   J. W. S.

Kinetics of the reduction of carbon dioxide by carbon. V. S. Altschuler and Z. F. Tschuchanov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 706—710).—A three-stage mechanism is proposed : (i) $CO_2 + C \rightarrow CO_2$ (adsorbed) ; (ii) CO_2 (adsorbed) $+ C \rightarrow$ surface complex C_xO_y ; (iii) $C_xO_y \rightarrow CO + C$, by thermal decomp. ; (iv) $C_xO_y + CO_2$ (gas) $\rightarrow CO + C$. (iii) is negligible at atm. pressure. (iv) and (ii) determine the overall velocity and an expression connecting the velocity coeffs. K_{II} and K_{IV} and the energies of activation of these stages with the effective area of the C and the concn. of CO_2 is deduced. Experimental evidence is adduced in support of the conclusion that if $K_{IV}[CO_2]/K_{II} \ll 1$ the order of reaction is unity and if $\gg 1$ the order is zero.   T. H. G.

Kinetic method for the investigation of the intermediate products in autocatalytic reactions. N. N. Semenov and N. M. Emanuel (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 219—223).—On keeping a mixture of H_2S and O_2 in a vessel at 270° for a period < the induction period of the reaction, and then transferring it to another vessel at 300°, the total induction period is such as would be predicted from the combined periods in the two vessels, indicating that the intermediate product is carried over with the gas from one vessel to the other. If, however, the mixture, after having been kept at 270°, is brought into another vessel at 20° before being passed into the vessel at 300°, the induction period in the latter vessel approaches the normal val. as the time of keeping at low temp. is increased. The results indicate that the intermediate compound is decomposed at 20° according to a unimol. law with velocity coeff. 0·007 min.$^{-1}$, whilst the heat of activation of the decomp. is 8500 g.-cal. per mol.   J. W. S.

Ozone as oxidation catalyst. Explanation of the favourable effect of dilution of the ozone based on the laws of adsorption. E. Briner (*Helv. Chim. Acta*, 1940, **23**, 590—596).—In the oxidation of $NaHSO_3$ and of aldehydes catalysed by O_3 (cf. A., 1933, 680 ; 1940, I, 297) the reaction velocity (v) decreases much more slowly than does the concn. (c) of O_3 as the latter is diluted. A linear relation exists between log v and log c, from which it is inferred that v is $\propto$ the concn. of O_2 in the liquid–gas interface, and that this is related to the bulk concn. in the gas phase according to the Freundlich adsorption isotherm. (Cf. also A., 1941, I, 86.)   F. L. U.

Reaction velocities at low temperatures. III. Synthesis of diethyl acetal at temperatures between −44° and +25°. R. P. Bell and A. D. Norris (*J.C.S.*, 1941, 118—120).—The synthesis of $CHMe(OEt)_2$ in EtOH in presence of HCl has been studied at −44° to 25°. The kinetics are complicated by the equilibrium $EtOH_2^+ + H_2O \rightleftharpoons EtOH + OH_3^+$, set up with the H_2O produced in the reaction. When this is allowed for the vals. of k_c, the catalytic coeff. of the $EtOH_2^+$ ion, follow the Arrhenius equation normally; $k_c = 2·34 \times 10^{13} e^{-15,500/RT}$.   F. J. G.

Ammonia synthesis from active nitrogen and hydrogen. S. S. Joshi and A. Purushotham (*Current Sci.*, 1940, **9**, 534—535).—A carefully regulated stream of active N was led over a catalyst, followed by a stream of H_2 previously subjected to electrical discharge. Appreciable formation of NH_3 was found with Mg, Cd, Al, S, Cr, and monazite, but the yields with Al_2O_3, Zn, As, W, Ni, Se, Sn, Co, and Ca were poor. Increased yields were obtained by heating the catalyst, and also the N_2 before activation, to 200°. For successful yields it appears necessary that the nitride formed by the catalyst should be unstable and reactive towards H_2.   W. R. A.

Interactions of gases with metals and crystalline solids. J. K. Roberts (*Physical Soc. Rep. Progr. Physics*, 1940, **7**, 303—328).—A progress report.   W. J.

Constitution and properties of cyanide plating baths.—See B., 1941, I, 148.

Corrosion of copper electrodes by aqueous iron sulphate containing titanium sulphate.—See B., 1941, I, 146.

Anodic oxidation of aluminium.—See B., 1941, I, 149.

Investigation of lead anodes in the electrolysis of zinc sulphate solutions.—See B., 1941, I, 146.

Electrodeposition of chromium from potassium dichromate baths in presence of fluoride.—See B., 1941, I, 147.

Theory of electrodeposition of chromium.—See B., 1941, I, 147.

Anodic polishing of electroplated nickel.—See B., 1941, I, 147.

Rhodium plating and stripping of rhodium deposits.—See B., 1941, I, 148.

Chemical action of electric discharges. XVIII. Production of formaldehyde in a high- and low-frequency arc. E. Briner and H. Hoefer (*Helv. Chim. Acta*, 1940, **23**, 800—806).—The mixtures studied were $CO-H_2$, $CO-CH_4-O_2$, CH_4-O_2, $C_3H_8-O_2$, and $C_4H_{10}-O_2$, all at 40—50 mm. pressure. Increase in the frequency (n) of the a.c. arc results in a marked increase in the amount of CH_2O formed, which, at $n = 50$ per sec., is always <1 g. per kw.-hr. The best results were obtained with CH_4-O_2 (O_2 4%) mixtures, which at $n = 10^7$ per sec. gave 16·6 g. of CH_2O per kw.-hr. Alcohols, ketones, other aldehydes, and (in presence of CH_4) C_2H_2 are formed in side-reactions.   F. L. U.

Optical sensitising of silver halides by dyes. III. Relation of sensitising to the absorption spectra and constitution of dyes. S. E. Sheppard, R. H. Lambert, and R. D. Walker (*J. Chem. Physics*, 1941, **9**, 96—113 ; cf. A., 1939, I, 315, 480 ; 1940, I, 367).—Various investigations of the differences between the absorption spectra of sensitising dyes when adsorbed on Ag halides and when in EtOH solution are summarised. The spectra of the adsorbed dyes correspond with their spectra in solution, and are similarly affected by structural changes, but they are shifted to longer λ. Similar shifts, however, are produced on comparing the spectra of solutions in different solvents, and it is pointed out that it is the displacement relative to the absorption bands for the dye in the gaseous state at low pressure which should correspond with an adsorption energy available for sensitisation. Such energy difference, however, is generally insufficient. The essential requirements for " mol." sensitisation are (i) planar configuration of the dye mol. and adsorbed dye ions, (ii) edge-on adsorption of planar mols., oriented possibly orthogonally but more probably at 70° to the (111) plane of the crystal, and (iii) electronic transition in the dye ion or dipole on absorption of a photon polarised in an azimuth defined by (i) and (ii). A hypothesis of coplanar coupling of electronic displacements in the dye and in a congruent plane of the Ag halide lattice is advanced, and is considered to be the key factor for both mol. and aggregate optical sensitisation by dyes. The influence of nuclear changes and of substituents on the sensitising action is discussed.
          J. W. S.

Isomeric transformation of chromium chloride in the dark and in ultra-violet light. D. S. Datar and M. Qureshi (*J. Osmania Univ.*, 1940, **8**, 6—20).—The isomerisation of dark green $CrCl_3,6H_2O$ in aq. solution may be followed by observation of extinction coeffs., p_H, and Λ; at ~25°, in the dark, these attain const. vals. after ~6½ hr. On exposure to ultra-violet light the changes are accelerated, and moreover

a solution which has reached equilibrium in the dark undergoes further change on irradiation.   F. J. G.

Photochemical reaction in the region of electron affinity spectrum of chromous ions in solution. B. Dain and E. Liberzon (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 228—230).—When $CrSO_4$ solutions are exposed to the light of a Hg-vapour lamp, H_2 is evolved owing to the reaction $Cr^{..} + H_2O \rightarrow Cr^{...} + OH' + H$. The reaction is not produced by light of λ 3660 or 3130 A., and apparently corresponds with the absorption region at <3000 A. After an initial induction period, corresponding with the saturation of the solution with H_2, the evolution of H_2 occurs at a const. rate which is almost independent of temp.   J. W. S.

Mechanism of the primary photodissociation of organic molecules. E. Bergmann and R. Samuel (*J. Org. Chem.*, 1941, **6**, 1—24).—An extended account of work already abstracted (A., 1938, I, 341). Special reference is made to CH_2O, HCO_2H, $AcOH$, $EtOAc$, $MeCO\cdot SH$, $MeCS_2H$, $CS(NH_2)_2$, $MeCHO$, $EtCHO$, $COMe_2$, CH_2Ac_2, Ac_2, $CH_2Ac\cdot CO_2Et$, and $AcOH$.   H. W.

Effect of neutrons on photosynthesis.—See A., 1941, III, 314.

IX.—METHODS OF PREPARATION.

Genesis of chemical reactions. N. S. Akulov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 135—138).—A theory of the autogenesis of reactions is developed.   O. D. S.

Salts. M. Usanovitsch (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 438—440).—Salts may be regarded as derived from bases (anions), but not from acids. Thus, NaCl is a salt of a base (Cl′) but not of HCl. The reactions: $NaOEt + EtCl \rightarrow NaCl + Et_2O$, $NaOEt + AcCl \rightarrow NaCl + EtOAc$, $NaOAc + AcCl \rightarrow NaCl + Ac_2O$, $Na_2SO_3 + SOCl_2 \rightarrow 2NaCl + 2SO_2$, may all be regarded as methods of salt formation, and are analogous to $NaOH + HCl \rightarrow NaCl + H_2O$, so that NaCl may be regarded as the salt of the base NaOAc and the acid AcCl. Solvolysis of a salt depends entirely upon the solvent. NaCl is alkaline in Ac_2O solution, the acid produced (AcCl) being weaker than the base (NaOAc).   A. J. M.

Absolute water and its use. J. Koppányi (*J. Hung. Chem. Soc.*, 1940, **1**, No. 3, 12—13).—Austerweil's method for the purification of H_2O by reversible acid or base exchange for OH′ or H′ with insol. basic or acidic compounds, "alassions" (**I**), is described. Only very weak acids are not removed by (**I**), which is regenerated with H_2SO_4 or aq. NH_3, respectively. H_2SiO_3 in the H_2O is first pptd. with $NaAlO_2$, and CO_2 must be removed.   E. V. A.

Use of copper and brass tubes [for water supplies].—See B., 1941, III, 83.

Reaction of hydrogen and oxygen in the presence of silver. Third explosion limit. H. R. Heiple and B. Lewis (*J. Chem. Physics*, 1941, **9**, 120).—When Ag is arranged at the centre of a tube heated at 625—660° no change is observed when H_2 is passed through the tube, but when O_2 is passed through the tube an orange-brown deposit appears on the tube walls. When a H_2-O_2 mixture is passed through the tube a greenish-brown deposit is formed of outline similar to that of the Ag used. The intensity of the deposit in the latter case may be due, not only to the formation of a volatile Ag oxide, but also to sputtering of Ag atoms through the reaction at its surface. Hence the suppression of the chain reaction at 700° in a Ag vessel (A., 1933, 469) may be due to chain-breaking through the action of Ag atoms in the gas phase.   J. W. S.

Washing reclaimed silver nitrate crystals with alcohol leads to explosion. J. P. Tully (*Canad. Chem.*, 1941, **25**, 90).—A dangerous explosion occurred when ~0.75 lb. of moist $AgNO_3$ crystals, obtained from AgCl residues by dissolving the button of Ag from the Na_2CO_3 fusion in HNO_3 and crystallising, had been washed with EtOH denatured with 10% $COMe_2$, and were touched with a spatula. The detonation was due to the formation of AgONC. Methods for eliminating the EtOH washing are suggested.   L. S. T.

Influence of humidity on atmospheric corrosion of zinc, aluminium, and iron coated with electrolytes.—See B., 1941, I, 146.

Preparation of base-exchange materials from some British clays and minerals.—See B., 1941, I, 117.

Mixed platinum triammino-thiosulphates. D. I. Riabtschikov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 236—239).—Treatment of $trans$-$[Pt\{CS(NH_2)_2\}_2(NH_3)_2]Cl_2$ (0.3 g.) with aq. $Na_2S_2O_3,5H_2O$ (**I**) (0.1645 g.) yields a white cryst. ppt. of the *compound*, $trans$-$[Pt\{CS(NH_2)_2\}_2(NH_3)_2(S_2O_3)]$. With 0.329 g. of (**I**) no ppt. is produced owing to the formation of the sol. $trans$-$Na_2[Pt(NH_3)_2(S_2O_3)_2]$. Treatment of a hot solution of $trans$-$[Pt(C_5H_5N)_2\{CS(NH_2)_2\}_2]Cl_2$ (0.3 g.) with (**I**) (0.1743 g.) yields a white cryst. ppt. of the *compound*, $trans$-$[Pt(C_5H_5N)_2\{CS(NH_2)_2\}]S_2O_3$. Excess of (**I**) had no further effect. With $trans$-$[Pt(NH_3)_2(C_5H_5N)_2]$ (0.3 g.), (**I**) (0.1625 g.) yields slowly small prisms of the *compound*, $trans$-$[Pt(NH_3)_2(C_5H_5N)(S_2O_3)]$. With 0.325 g. of (**I**) there is slow formation of $trans$-$Na_2[Pt(NH_3)_2(S_2O_3)_2]$, which on addition of $BaCl_2$ and H_2SO_4 yields a light cream ppt. of the *compound*, $trans$-$Ba[Pt(NH_3)_2(S_2O_3)_2]$. By treatment of this salt with H_2SO_4 it has been shown that the corresponding acid (**II**) is a strong acid, a 0.005M. solution having p_H 2.05. Treatment of the acid with $[Pt(NH_3)_4]Cl_2$ yields a cryst. ppt. of the *compound*, $trans$-$[Pt(NH_3)_4][Pt(NH_3)_2(S_2O_3)_2]$. With $trans$-$[Pt(NH_3)_2(C_5H_5N)_2]Cl_2$ (**III**) (0.3 g.), (**I**) (0.2056 g.) and $CS(NH_2)_2$ (0.063 g.) yield a white ppt. of the *compound*, $[Pt(NH_3)(S_2O_3)(C_5H_5N)\{CS(NH_2)_2\}]$. With (**I**) (0.4112 g.), (**III**) (0.3 g.) yields $trans$-$Na_2[Pt(C_5H_5N)(NH_3)(S_2O_3)_2]$, which with $[Pt\{CS(NH_2)_2\}_4]Cl_2$ yields golden yellow needles of the *compound*, $trans$-$[Pt\{CS(NH_2)_2\}_4][Pt(C_5H_5N)(NH_3)(S_2O_3)_2]$. The *compound*, $trans$-$Ba[Pt(C_5H_5N)(NH_3)(S_2O_3)_2]$, is almost white and with H_2SO_4 yields a solution of the free acid, similar in properties to (**II**).   J. W. S.

Reaction of thiosulphate with isomeric compounds of bivalent platinum. D. I. Riabtschikov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 231—235).—Treatment of $trans$-$[Pt(NH_3)_2Cl_2]$ (0.3 g.) with hot aq. $Na_2S_2O_3,5H_2O$ (**I**) (0.248 g.) yields a turbid solution which deposits the sparingly sol. *compound*, $trans$-$[Pt(NH_3)_2(S_2O_3)(H_2O)]$. The H_2O is very firmly held and is not removed by drying at 110°. With 0.496 g. of (**I**), however, no ppt. is formed owing to the production of the sol. $trans$-$Na_2[Pt(NH_3)_2(S_2O_3)_2]$, whilst with <1.98 g. of (**I**) the solution turns yellow owing to the production of $Na_6[Pt(S_2O_3)_4]$ (**II**). When cis-$[Pt(NH_3)_2]Cl_2$ (**III**) (0.3 g.) is treated with (**I**) (0.248 g.) the solution turns yellow owing to the formation of cis-$Na[Pt(NH_3)_2(S_2O_3)Cl]$ (**IV**), which on treatment with $[Pt(NH_2)_4]Cl_2$ (**V**) or $[Pt\{CS(NH_2)_2\}_4]Cl_2$ yields ppts. of the *compounds*, cis-$[Pt(NH_3)_4][Pt(NH_3)_2(S_2O_3)Cl]$ and cis-$[Pt\{CS(NH_2)_2\}_4][Pt(NH_3)_2(S_2O_3)Cl]$, respectively. Addition of saturated aq. KCl and EtOH to the original solutions immediately after mixing causes pptn. of the *compound*, cis-$K[Pt(NH_3)_2(S_2O_3)Cl]$. When (**IV**) is kept in solution a yellowish powdery ppt. of the *compound*, $[Pt(NH_3)_2(S_2O_3)]$, gradually separates. When (**III**) (0.3 g.) is treated with (**I**) (0.496 g.) cis-$Na_2[Pt(NH_3)_2(S_2O_2)_2]$ is formed, this on treatment with (**V**) yielding a ppt. of the *compound*, cis-$[Pt(NH_3)_4][Pt(NH_3)_2(S_2O_3)_2]$. The *compound*, cis-$K_2[Pt(NH_3)_2(S_2O_3)_2]$, has also been isolated. With excess of (**I**), (**III**) yields (**II**). The behaviour of these complexes is compared with that of the $CS(NH_2)_2$ complexes.   J. W. S.

X.—ANALYSIS.

Isotopes as indicators. C. Rosenblum (*J. Chem. Educ.*, 1940, **17**, 567—570).—A review.   L. S. T.

Application of colorimetric methods to metallurgical analysis.—See B., 1941, I, 149.

Improvement in mixing starch solution. N. M. Cullinane (*Chem. and Ind.*, 1941, 146).—If 1 g. of starch is mixed to a cream with a little H_2O, and 100 c.c. of boiling H_2O added, the solution may be kept for three months without deteriorating. Addition of 2 drops of conc. HCl or 1 g. of $ZnCl_2$ is an improvement.   F. J. G.

Mixing starch solution. R. C. Terry (*Chem. and Ind.*, 1941, 185).—0.1% of HgI_2 or Shirlan (an anti-mildew agent for cotton) preserves 1% starch paste for an indefinite period. Neither preservative interferes with the K_2PtI_4 test for mustard gas.   A. J. E. W.

Determination of fluorine. P. A. Clifford (*J. Assoc. Off. Agric. Chem.*, 1940, **23**, 303—307).—The titration of F with

Th(NO$_3$)$_4$ in the presence of alizarin as indicator is not successful for the determination of amounts <50 μg. The dil. Th solution (0·0004N.) used does not give a satisfactory end-point with the indicator; neutral salts also affect the end-point. A suitable procedure to eliminate these errors is suggested. F combines with Al to form AlF$_6$'', which interferes with the formation of the Al aluminon lake. Under standard conditions the bleaching of the coloured lake ∝ [F.].

E. C. B. S.

Thorium nitrate titration of micro-quantities of fluorine in aqueous and alcoholic systems. J. W. Hammond and W. H. Macintire (*J. Assoc. Off. Agric. Chem.*, 1940, **23**, 398—404).— Titration of F' by Th(NO$_3$)$_4$ in 48% EtOH adjusted to p_H 3·0 with HCl gives stoicheiometric results in both μg. and mg. ranges. Na alizarinsulphonate is used as indicator. A similar titration in aq. solution, or in 48% EtOH in the presence of a CH$_2$Cl·CO$_2$H–CH$_2$Cl·CO$_2$Na buffer, gives high results in the μg. range.

E. C. B. S.

Determination of nitrates (in water) by the phenoldisulphonic acid method. J. S. Dunn (*Analyst*, 1941, **66**, 105).—The colours of the B.D.H. Nessleriser Disc for the determination of free Cl$_2$ by means of *o*-tolidine provide good matches for the yellow tints obtained in the phenoldisulphonic acid method of determining ⊹0·01 mg. of NO$_3$'-N.

L. S. T.

Determination of small quantities of hydroxylamine by Blom's method. H. Barnes (*J. Marine Biol. Assoc.*, 1941, **25**, 109—110).—NO$_2$' in very dil. solution is not recovered quantitatively by Griess' method after treatment with Blom's reagents for the determination of NH$_2$OH because of the presence of S$_2$O$_3$'', very small quantities of which interfere with the colour reaction.

J. L. D.

Spectrographic determination of phosphorus in phosphor-bronze.—See B., 1941, I, 146.

How technique for micro-determination of arsenic. T. Wilkinson and C. G. Greenham (*Austral. J. Exp. Biol.*, 1940, **18**, 341—342).—How's procedure (A., 1938, I, 322) is modified. An alloy containing Zn 99·5, Sn 0·5, Pb 0·1, Fe 0·1 g. is used; 0·125% HgCl$_2$ solution is preferable, and a wringer giving reproducible pressure is necessary. 2 ml. of 5% FeSO$_4$,(NH$_4$)$_2$SO$_4$,6H$_2$O, slightly acidified (H$_2$SO$_4$), is placed in each generation tube; after adding the digested material and aq. NaHSO$_3$ and diluting, 0·2 c.c. of 40% SnCl$_2$ in conc. HCl is added. Freshly impregnated string is essential.

D. M. N.

Determination of arsenic. C. C. Cassil (*J. Assoc. Off. Agric. Chem.*, 1940, **23**, 297—301). In Cassil and Wichmann's method (B., 1939, 1173) it is desirable to omit the addition of KI (reagent g) and to prepare reagent k from sol. starch; the Zn should be 20-mesh, and SnCl$_2$ should not be added before the final dilution is made.

E. C. B. S.

Interference of selenium and tellurium with the determination of arsenic by the hypophosphorous acid method. H. J. G. Challis (*Analyst*, 1941, **66**, 58—60).—In presence of Se and Te, the determination of As in Cu by Evans' method (A., 1932, 1010) yields high results. In a modified method the sample (5 g.) is dissolved, without boiling, in dil. H$_2$SO$_4$ (30 ml.) and conc. HNO$_3$ (15 ml.), and the solution is evaporated until the CuSO$_4$ becomes grey. The residue is warmed with dil. HCl (150 ml.), NaH$_2$PO$_2$ (3 g.) is added to decolorise the Cu salts, and the solution is warmed to 50°. In presence of Se or Te a red or brownish colour or ppt. is formed, and persists after the addition of 1—2 g. more NaH$_2$PO$_2$. The solution is maintained at 50° for 30 min., and the ppt. is separated, and washed with dil. HCl. The filtrate is treated with more NaH$_2$PO$_2$ and the As determined by Evans' method.

J. W. S.

Qualitative semimicro-analysis with reference to Noyes and Bray's system : the thallium group. C. C. Miller (*J.C.S.*, 1941, 72—75).—Working details are given of a scheme for the detection and determination of 0·25—50 mg. of Ag and Pb, 0·25—10 mg. of Tl, and some Bi, in mixtures containing ⊹50 mg. of the metals. The scheme involves dissolution of the bromides in HBr, detection of Tl with rhodamine-B, extraction of TlBr$_3$ by means of Bu^{a}OAc, detection of Ag in a CN' solution with *p*-dimethylaminobenzylidenerhodanine, detection of Bi and Pb with CS(NH$_2$)$_2$, and confirmation of Pb as rhodizonate.

F. J. G.

Spectroscopic analysis of enamel frits.—See B., 1941, I, 137.

Micro-determination of calcium and magnesium [in soil].—See B., 1941, III, 61.

Determination of lead in drinking water.—See B., 1941, III, 83.

Assay of lead oleate plaster and ointment.—See B., 1941, III, 76.

Determination of copper as the diethyl dithiocarbonate complex. D. L. Drabkin (*J. Assoc. Off. Agric. Chem.*, 1940, **23**, 301—302).—A photometric procedure was applied to a solution of the complex in *iso*amyl acetate; the effect of contamination with Bi, Co, and Ni was studied.

E. C. B. S.

Electrolytic determination of copper in steel.—See B., 1941, I, 145.

Micro-cerimetric determination of electrolytic copper.—See B., 1941, I, 146.

Analysis of mercury ores.—See B., 1941, I, 147.

Assay of mercuric oxide ointment.—See B., 1941, III, 70.

Spectrographic analysis of aluminium alloys.—See B., 1941, I, 148.

Determination of ferric and ferrous iron. J. O. Percival (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 71—72).—A rapid (10 min.) method for determining Fe''' in Fe$_2$(SO$_4$)$_3$ pickling baths for brass and other Cu alloys is described, and shown to be accurate by comparison with the SO$_2$ and SnCl$_2$ reduction methods. Pptd. Cu powder is used as reducing agent in the cold, and the reduced solution is titrated with 0·1N-KMnO$_4$. Large amounts of Fe'', Cu'', Mn'', Zn'', Ni'', and Cr''' do not interfere; Cl' must be absent.

L. S. T.

Determination of iron by the Zimmerman–Reinhardt method. Effects of temperature, and determination of blank. W. R. Crowell, W. W. Luke, and T. G. Mastin (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 94—95).—Comparison of data obtained by the Zimmerman–Reinhardt and Jones reductor methods shows that between 10° and 40° the results by the former method are practically unaffected by temp. during the treatment with HgCl$_2$. Titration with KMnO$_4$ is better done at 30° than at 10°. In the procedure detailed, the blank is unaffected by temp. (10—40°) and by the amount of SnCl$_4$, but it is dependent on the vol. of the solution, the amount of preventive solution, and particularly on the amount of FeCl$_3$ present. Under optimum conditions the results obtained by the Zimmerman–Reinhardt method were 0·08% > those obtained with the Jones reductor.

L. S. T.

Basic sulphates of iron and aluminium in analytical separations. J. G. Fairchild (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 83; *cf.* A., 1934, 628).—Excess of Fe''', together with some Al''', is separated from bivalent metals by pptn. as basic K Fe^{III} alum. A slightly acid solution of Fe$_2$(SO$_4$)$_3$, free from F', Cl', or NO$_3$', is treated with KHSO$_4$, and neutralised with dil. aq. NH$_3$ until a slight ppt. persists. The solution is heated in a closed flask immersed in steam for several hr.; ~5 mg. of Fe remain in solution. Ni and Zn can then be determined in the filtrate by the procedures described.

L. S. T.

Photometric determination of iron.—See A., 1941, III, 315.

Polarographic determination of nickel and cobalt. Simultaneous determination in presence of iron, copper, chromium, and manganese, and determination of small amounts of nickel in cobalt compounds. J. J. Lingane and H. Kerlinger (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 77—80).—The half-wave potential of Ni is 0·3 v. more positive than that of Co in supporting electrolytes containing C$_5$H$_5$N (I) or CNS', and the separation of the two waves permits the simultaneous determination of both metals. An electrolyte containing (I) is preferred to one containing CNS'. With the latter, the diffusion current of Co shows irregularities, especially in solutions containing acid or NH$_4$'. In an electrolyte of ~p_H 5·4 containing equal concns. of (I) and a pyridinium salt, Fe''' is separated sharply from small amounts of Ni, Co, and Cu, by pptn. as Fe$_2$O$_3$,nH$_2$O. Ni'' and Co'' are not co-pptd., and the method is suitable for the simultaneous determination of Ni and Co in steel. Moderate amounts of Cr''' in steel are co-pptd. completely with the Fe$_2$O$_3$,nH$_2$O. Mn'' and small amounts of Cu'' do not interfere. Cu gives a double wave at +0·05 and −0·25 v. against the saturated Hg$_2$Cl$_2$ electrode in (I), and large amounts must be removed

before the Ni–Co determination. Small amounts of Ni impurities in Co compounds can be rapidly and accurately determined in an electrolyte containing (I) or CNS′.

L. S. T.

Rapid detection of chromium in stainless steels, other high-chromium alloys, and plating.—See B., 1941, I, 145.

Determination of chromates in sewage liquors.—See B., 1941, III, 82.

Precipitation of stannic sulphide. W. C. G. Wheeler (*Analyst*, 1941, **66**, 61).—In absence of Fe and metals other than Sn pptd. by H_2S in acid solution, NH_4 tartrate should be added before pptg. SnS_2 with H_2S. The ppt. is voluminous but not difficult to handle, but the addition of a little aq. SO_2 towards the end of the saturation with H_2S granulates the ppt.   J. W. S.

Electrolytic determination and separation of bismuth. III. Determination and separation from copper in alkaline solution. F. G. Kny-Jones (*Analyst*, 1941, **66**, 101—104).—Rapid and accurate determinations of Bi alone or in presence of Cu can be made in alkaline tartrate solutions containing $(NH_4OH)_2.H_2SO_4$ as depolariser. Other depolarisers are unsuitable; N_2H_4 salts or glucose cause blackening, citrates and formates fail to prevent the formation of the pentoxide, and quinol leads to low results. CH_2O leads to the formation of colloidal Bi (cf. *J.C.S.*, 1907, **91**, 373). Procedure and test data are given.   L. S. T.

XI.—APPARATUS ETC.

Temperature and temperature scales. H. T. Wensel (*J. Appl. Physics*, 1940, **11**, 373—387).—A survey of fundamental concepts of, and methods of expressing, temp. The basis and significance of a thermodynamic scale are discussed, and its relation to various practical scales, in particular the International temp. scale, is explained.   N. M. B.

Temperature scale; proposed change in definition. F. G. Brickwedde (*J. Appl. Physics*, 1940, **11**, 371—372).—The Joule–Thomson definition of temp. scale based on considerations of ideal gases may be completed by assigning an arbitrarily chosen no. to either the temp. of some one reproducible thermal state, or to the difference between the temp. of two states. The former is advocated to supersede the latter, and advantages are discussed.   N. M. B.

Thermoelectric thermometry. W. F. Roeser (*J. Appl. Physics*, 1940, **11**, 388—407).—A comprehensive review of fundamental laws and theories, their historical development, and application to temp. measurement. Thermocouples and their use are examined from the practical viewpoint.
N. M. B.

Wheatstone bridge circuits for automatic temperature regulators. F. W. Jones (*J. Sci. Instr.*, 1941, **18**, 48—49).—In the two circuits described some of the more expensive units are replaced with the less expensive potentiometers and multi-tapping switches supplied by radio-component manufacturers.   C. R. H.

Accurate constant-temperature bath and storage cabinet for operation below room temperature. R. M. Dolby (*New Zealand J. Sci. Tech.*, 1940, **22**, 49—51B).—A refrigerator unit is used to cool an auxiliary bath, from which cold H_2O is admitted to the const.-temp. bath through an electromagnetically-operated thermostatic valve. A pump which also provides the necessary stirring returns excess of H_2O to the auxiliary bath. The temp. control of the bath is accurate to $\pm 0.05°$ at 5—15°, whilst the temp. inside a storage compartment immersed in the thermostat is $> 0.1°$ above the temp. of the H_2O except immediately after opening. The apparatus was devised for investigations on butter.
J. W. S.

Temperature radiation emissivities and emittances. A. G. Worthing (*J. Appl. Physics*, 1940, **11**, 421—437).—Methods of measuring the various emissivities (normal, hemispherical, spectral, total, luminous, and colour) and corresponding emittances of substances are reviewed. Available data for 15 metals are tabulated and general tendencies indicated thereby are summarised.   N. M. B.

Optical pyrometry. W. E. Forsythe (*J. Appl. Physics*, 1940, **11**, 408—420).—A review of the principle and construction of pyrometers, use of monochromatic screens, rotat-

ing sectors, and absorbing screens. Calibration and accuracy tests are described, and practical data are tabulated and plotted.   N. M. B.

Inexpensive polarising device for microscopes. H. A. Derow (*J. Lab. clin. Med.*, 1941, **26**, 694—695).—Pieces of polaroid film are fitted in the eyepiece and beneath the condenser.   C. J. C. B.

Photo-electric fluorimeter and some applications. F. Kavanagh (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 108—111).—In the arrangement described the fluorescence of an unknown solution is measured in terms of that of a standard. Uncertainties due to fluctuations and drifts of lamp intensity, non-linear galvanometer scale, and inconstancy of galvanometer response are eliminated. The galvanometer is used as a null-point indicator, and the ratio of the fluorescence of the unknown to that of the standard is indicated by a potentiometer. The instrument has been tested by determinations of thiamin, riboflavin, chlorophyll, and Al.   L. S. T.

Ultra-violet photometer. Quantitative measurement of small traces of solvent vapours in air. V. F. Hanson (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 119—123).—The photometer measures low concns. of tri- (10 p.p.m.) and per-chloroethylene (0·3 p.p.m.) in air, and is applicable to low concns. (< 0.13 p.p.m.) of many toxic org. vapours. Details of the principles of operation, construction, and application are described and illustrated.   L. S. T.

Colour comparator. R. H. Wilhelm (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 123).—The comparator described utilises the property of acrylate or methacrylate resins of transmitting light through curved bars without appreciable loss. Two bars curved at one end and enclosing Al foil as a reflector at the straight ends are cemented together, and serve to bring colour images into adjacent fields.   L. S. T.

(A) **Device for rocking a crystal in a vacuum X-ray spectrograph.** (B) **Simple design for the crystal support assembly in a vacuum X-ray spectrograph.** J. W. McGrath (*Rev. Sci. Instr.*, 1940, **11**, 396).—(A) The crystal table is rotated by a lever and cam, the lever passing out of the vac. chamber through a small brass bellows.

(B) The table is mounted on a shaft, which is held in position by two precision radial bearings, 4 in. apart. The bearings are housed in a heavy brass mounting and the whole assembly is enclosed in a vac.-tight brass can soldered to the underside of the spectrograph.   D. F. R.

Simplified system of buffers and indicators with or without glass electrodes. J. F. McClendon (*J. Lab. clin. Med.*, 1940, **26**, 568—575).   C. J. C. B.

Tungsten–nickel and tungsten–silver electrode systems in neutralisations. H. G. Dietrich and P. J. Bender (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 105—107).—The data recorded show that the W–Ni electrode system is satisfactory for the titration of strong acids in 0·1N. concns. (cf. A., 1933, 572), but is of little val. in titrating 0·01N. solutions. The W–Ag system gives precise and accurate end-points in titrations of strong acids by strong bases in 0·001N. solutions, and vice versa in 0·01N. solutions. At higher concns. the system is of val. in the neutralisation of strong acids by aq. NH_3, of AcOH by a strong base, and of Na_2CO_3.   L. S. T.

Stroboscope and circuit for charging condensers to high direct current potentials. G. H. Wagner and W. G. Eversole (*J. Chem. Educ.*, 1940, **17**, 587—588).   L. S. T.

Spring pendulum current interrupter for a magnetic stirrer, with application to an experiment in catalysis. V. A. Lamb and M. M. Haring (*J. Chem. Educ.*, 1940, **17**, 577—579).—The construction of an interrupter for use with a magnetic stirrer is described and illustrated. The stirrer has been applied to investigating the decomp. of H_2O_2 catalysed by 0·05N-KI.   L. S. T.

Quantum efficiency of Geiger–Müller counters for X-ray intensity measurements. H. M. Sullivan (*Rev. Sci. Instr.*, 1940, **11**, 356—362).—The counting rate increases when the photons exciting the counter possess sufficient energy to excite radiations from the cathode material (Zr), the increase occurring at the crit. Zr K absorption limit. The quantum efficiency for an A–O_2-filled counter is 5·7% when excited by Mo $K\alpha_{1}\alpha_{2}$ radiation and 15·7% when excited by Mo $K\beta_{1}\beta_{2}$ radiation; the corresponding vals. for a H_2-filled

counter are 4·0 and 15·0%. Abs. X-ray intensity measurements made with the two counters agree to within 3%.

           D. F. R.

Low-capacity coupler for cathode-ray oscilloscope. W. P. Overbeck and J. L. C. Löf (*Rev. Sci. Instr.*, 1940, **11**, 375—376).—The voltage to be observed modulates an oscillator isolated from earth and the resulting output is loosely coupled to a detector built into the oscilloscope. This eliminates disturbance in high-impedance circuits by the relatively low impedance to earth of one of the oscilloscope amplifier input terminals.   D. F. R.

Recorder for electric potentials. Damping of piezoelectric systems. F. Offner (*J. Appl. Physics*, 1940, **2**, 347—352).—The phase-frequency, amplitude-frequency, and transient characteristics of a Rochelle salt ink-writing oscillograph are calc. The insertion of a series resistor improves these characteristics but cannot achieve crit. damping as the necessary coeff. of coupling, >0·943, is unobtainable in a crystal. Comparison with a cathode-ray oscillograph record of a bioelectric potential is given.   D. F. R.

Chemical applications of the mass-spectrograph. W. Wahl (*Finska Kem. Medd.*, 1940, **49**, 18—41).—A review.

           M. H. M. A.

Tests to indicate the condition of an analytical balance. L. C. Kreider (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 117—118).—Double weighings by Gauss' method are made with loads of 10 to 100 g. on each pan and the constancy of rest-point and the sensitivities are examined from the data obtained.

           L. S. T.

Calibration of volumetric apparatus. C. R. Johnson (*J. Chem. Educ.*, 1940, **17**, 582—583).—A method of calibrating this apparatus with H_2O as a reference standard is described.

           L. S. T.

Fractional distillation column. H. R. Snyder and R. L. Shriner (*J. Chem. Educ.*, 1940, **17**, 588—590).—Laboratory apparatus is described, and its use illustrated.   L. S. T.

Distillation of foaming solutions under vacuum. D. R. Rexford (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 95—96).—In the apparatus and method described, bubble formation is arrested and built-up foam masses are destroyed by means of fluctuations in the reduction of pressure employed.

           L. S. T.

Semimicro- and micro-Kjeldahl steam distillation unit. J. H. Brant and D. C. Sievers (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 133).—A simpler and more flexible form of Kirk's apparatus (A., 1936, 955) is described and illustrated.   L. S. T.

Trends in design of fractionating pumps. K. C. D. Hickman (*J. Appl. Physics*, 1940, **11**, 303—313).—A review.

           D. F. R.

Large molecular pumps of the disc type. S. von Friesen (*Rev. Sci. Instr.*, 1940, **11**, 362—364).—A description of Siegbahn pumps, including one used in cyclotron work, capable of pumping at 73 l. per sec. at 10^{-3} mm. Hg at 3700 r.p.m.   D. F. R.

X-Ray method of determining rates of diffusion in the solid state. J. DuMond and J. P. Youtz (*J. Appl. Physics*, 1940, **11**, 357—365).—Artificially stratified layers, 100 A. thick, of Au and Cu, produced by controlled evaporation in vac., were subjected to Mo K radiation. The intensity of the diffracted image from these stratified films showed a gradual decay, with a half-life period of 2 days, due to the diffusion of Au through Cu. By measuring the rate of this decay, a rapid and accurate method of determining the rates of diffusion in the solid state is made possible. The diffusion coeff. of Au through Cu at room temp. is 5×10^{-20} cm.² sec.⁻¹

           D. F. R.

Measurement of tension in liquids by means of a metal bellows. R. S. Vincent (*Proc. Physical Soc.*, 1941, **53**, 126—140).—An historical review is given. A metal bellows, closed by a needle valve, contains the liquid under test and is completely surrounded by the liquid to exclude inward air. leakage. An increasing tensile load is applied to the bellows until the liquid breaks, and the hydrostatic tension prior to breaking is calc. Data at 0—30° for EtOH, Et_2O, and mineral oil are reported.   N. M. B.

Measurement of surface tension by the ripple method. E. Tyler (*Phil. Mag.*, 1941, [vii], **31**, 209—221).—Various graphical methods are suggested for obtaining the surface tension of a liquid by the measurement of ripples, and the use of the modified Kelvin equation. Three stroboscopic methods for measuring the frequency of ripple formation over a wide range of frequencies (20—400 per sec.) are described. The results agree well with those obtained by other methods.   A. J. M.

Method for measuring the internal area of section of a glass tube. D. J. Behrens (*Phil. Mag.*, 1941, [vii], **31**, 199—203).—An optical method for carrying out the above determination is described. It has the advantage of giving the area of section at a given point. It is also possible to find μ for the material of the tube if the end is accessible.   A. J. M.

Centrifuge accessories. C. R. Johnson and H. Miller (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 118).—Cups with perforated bottoms or interchangeable perforated plates are made from Lucite, and serve for the centrifugal drainage of crystals.

           L. S. T.

Rapid method for calibration of flowmeters. H. J. Meuron (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 114).—H_2O from a const.-head device forces gas from a cylinder through the flowmeter. Hg or oil can replace H_2O.   L. S. T.

Capillary tube experiments with gases. L. J. Kay (*J. Chem. Educ.*, 1940, **17**, 580—581).—Capillary apparatus for demonstrating the thermal dissociation of $CaCl_2,4NH_3$ or $ZnCl_2,4NH_3$, and for comparing the v.d. of two liquids, is described.

           L. S. T.

Mixture of bakelite and metal powder for mounting microspecimens. N. J. Finsterwalder (*Met. Progr.*, 1940, **38**, 294—295).—A conductive mounting medium permitting the electrical etching or polishing of micro-specimens consists of a mixture of bakelite with Cu or Al powder.   R. B. C.

Apparatus for the direct measurement of the absorption of sound in gases. R. W. Leonard (*Rev. Sci. Instr.*, 1940, **11**, 389—393).—The absorption coeff. is calc. from pressure-distance curves obtained by moving a microphone away from a piston source vibrating in a large baffle. The source is the end of a magnetostrictive rod driven by an improved Pierce oscillator with a frequency range of 11·3 to 112 kilocycles. The microphone was built up from a single bender-type Rochelle salt bimorph element and is moved magnetically through the measuring chamber.   D. F. R.

Rugged quartz membrane manometers of small volume. C. Kenty (*Rev. Sci. Instr.*, 1940, **11**, 377—386).—The manometers consist of clear fused quartz discs, plane polished, 0·1—0·5 mm. thick, and 0·5—2·5 cm. diameter, sealed on to fused quartz heads, either plane or slightly concave. Movement of the disc is measured by means of a three-legged rocker, the middle leg resting on the disc, in conjunction with a mirror or pointer and microscope, or by interference fringes set up between the disc and a nearby slightly concave quartz surface. The manometers are operable up to 800° and measure pressure ⊁50 atm. (±~0·1%). Vols. as small as 4 cu. mm., with resulting freedom from explosion hazard, have been attained.   D. F. R.

Bergman, Klaproth, Vauquelin, and Wollaston. E. G. Ferguson (*J. Chem. Educ.*, 1940, **17**, 555—562).   L. S. T.

XIII.—GEOCHEMISTRY.

New method of measuring the mean height of the ozone in the atmosphere. J. Strong (*J. Franklin Inst.*, 1941, **231**, 121—155).—The mean height of the O_3 in the atm. is determined by measuring the intensity of absorption of sunlight by three absorption bands : absorption in the ultra-violet by the Hartley band, to determine the total amount of O_3 overhead; absorption in the infra-red by the H_2O vapour band at 1·14 μ., to determine the total amount of H_2O overhead; and the absorption at 9·6 μ., which is due to both H_2O and O_3. The ultra-violet absorption in the Hartley band is approx. independent of pressure, whereas the infra-red absorption by $O_3 \propto$ (total pressure)$^{\frac{1}{2}}$. Thus the ultra-violet and infra-red absorptions together determine the average total pressure on the O_3, and hence the average height of the O_3 layer can be obtained. The val. obtained is ~25 km., which is rather > vals. obtained by other methods. Possible sources of error are discussed. The new method has the advantage that determinations can be made at all positions of the sun.   A. J. M.

Calcium carbonate content of sea [water] with special reference to the Baltic Sea. K. Buch (*Finska Kem. Medd.*,

1940, **49**, 64—87).—A crit. review of saturation conditions for $CaCO_3$ in the North Atlantic and Baltic Sea. An expression is given for deriving δ, the degree of super- or un-saturation (mg. equiv. of $CaCO_3$ per l. H_2O > or < saturation), from [Ca''], [Cl'], titration alkalinity, temp., and p_H of the corr. saturated solution. This last is calc. from p_H (obs.), [Cl'], and temp., and tables valid for various areas of the Baltic (to a depth of 20 m.) and graphs for deep H_2O in the Bornholm basin are given. Vals. of δ for the Atlantic between England and N. America and northwards from Iceland to the ice-limit are calc. From autumn to early summer the surface H_2O of the Baltic is unsaturated (with respect to $CaCO_3$) except in the extreme south, but becomes slightly supersaturated in summer, except in the extreme north of the gulf of Bothnia. The bottom H_2O is everywhere highly unsaturated at all seasons. Supersaturation in summer is due to growth of plankton, which raises the p_H, absence of nuclei preventing pptn. The surface layer is changed in autumn by convection but temp. has no direct influence on the saturation conditions. Vals. of δ for 81 sampling stations in the Baltic are given, in one case over a 9-years period. M. H. M. A.

Manganese slime carried off by the Kviril river. D. I. Eristavi (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 718—721).—H_2O taken at 5 points has been examined as to transparency, colour, p_H, sp. conductivity and wt. of suspended matter, rate of sedimentation, etc. The p_H varies from 7·5 to 7·8, showing a basic reaction both above and below the factories dressing Mn ores. The slime contains SiO_2 38, Mn 23, MnO 3, MnO_2 30, and Al_2O_3 10%, with oxides of Fe, Ti, Ca, |Mg, Ba, Ni, Co, V, S, P. The sp. conductivity is ~ $2·3 \times 10^{-4}$. T. H. G.

Present status of knowledge regarding the hydraulics of ground water. O. E. Meinzer and L. K. Wenzel (*Econ. Geol.*, 1940, **35**, 915—941).—A review. L. S. T.

Geochemical complexes. A. E. Fersman (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 148—150).—Three types are described : the primary geochemical, the metamorphic geochemical, and the mobile equilibrium complex. O. D. S.

" Bolshaya Korta " meteorite. A. A. Onosovskaja (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 122—123).—Olivine, plagioclase with admixture of albite, troilite, and a nickeliferous Fe mineral have been identified in the meteorite. O. D. S.

Geology of Ardgour, Argyllshire. H. I. Drever (*Trans. Roy. Soc. Edin.*, 1940, **60**, 141—170).—The distribution of the rock types and their field relationships, and the petrography of the rocks are described. Evidence of contact and regional metamorphism, and of contamination and metasomatism by acid magma, is discussed. Numerous chemical analyses are collected. L. S. T.

Field method for determining the magnetic susceptibility of rocks. R. C. Hyslop (*Amer. Inst. Min. Met. Eng.*, 1941, *Tech. Publ.* 1285, 4 pp.).—Curves obtained by means of the Schmidt vertical magnetometer are used to determine the magnetic susceptibility of rock specimens. L. S. T.

Determination of magnetic susceptibilities of rocks in situ. R. G. Paterson (*Amer. Inst. Min. Met. Eng.*, 1941, *Tech. Publ.* 1298, 9 pp.).—A method for determining susceptibilities of rocks or rock formations in situ by means of an a.c. bridge is described. Such vals. are preferable to those obtained on separate specimens. L. S. T.

Distribution of ammonites in the Lower Permian of the Urals and the resulting stratigraphic conclusions. S. V. Maximova and V. E. Rushentzev (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 160—163).—An analysis of the distribution of ammonites in the Lower Permian strata of the Urals indicates that the boundary between the Carboniferous and the Permian should be drawn at the base of the Sakmarian. O. D. S.

Axinite in the near-polar Urals. M. F. Beliakov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 158—159).—Axinites have been found associated with Lower Palæozoic metamorphic shales in the Ural range. O. D. S.

Loparite-bearing horizon at the Lovozero tundras. I. V. Zelenkov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 151—152).—A loparite-bearing urtite horizon is described. O. D. S.

Geochemical peculiarities of the serpentinites of the north Caucasus. N. E. Efremov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 336—339).—Serpentinites from the southern zone of the north Caucasus, formed by metamorphisation of a mafic magma, contain ~4—5% Al_2O_3, which is not found in those of the northern zone, produced from an ultramafic magma. The excess of Al_2O_3 is contained in the serpentine constituent, and is associated with a " hydrargillite " terrace at 300° in thermal analysis data; this is found both with the serpentinites of the southern zone and with serpentine individuals (antigorite) obtained therefrom. L. J. J.

Classification of serpentine minerals by the method of thermal analysis. N. E. Efremov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 442—445).—The serpentines have been investigated by thermal analysis, and the results of other workers are discussed. An exothermal effect, the extent of which depends on the composition of the mineral, is observed. In colloidal varieties the exothermal effect is absent.
A. J. M.

Titaniferous vesuvianite from the Perovskite and Akhmat mines, South Urals. V. S. Miasnikov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 446—449).—Analyses and physical properties are recorded. A. J. M.

Donbassites, a new group of minerals from the Donetz basin. E. K. Lazarenko (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 519—521).—Radial aggregates of a foliated mineral, previously mistaken for pyrophyllite, occur in the lode walls and crush zones of ore deposits and also on slickensides in coal and shale at several places in the Donetz basin, Ukraine. The pearly-white folia are flexible and have a perfect cleavage, d 2·628, H 2¼, a 1·728, $β$ 1·729, $γ$ 1·735. Three analyses show SiO_2 33·64—34·73, Al_2O_3 45·02—48·08, H_2O 13·20—15·20%, with small amounts of Fe_2O_3, MgO, CaO, Na_2O, Li_2O. The formulæ $H_{14}Al_8Si_5O_{29}$, $H_{18}RAl_{10}Si_6O_{37}$, and $H_{16}RAl_{10}Si_6O_{36}$ are based on the chloritoid nucleus $H_2Al_2SiO_6$ (margaritic acid of Vernadsky). Only 0·017% H_2O is lost at 450°.
L. J. S.

Theory of mineral sequence in hypogene ore deposits. L. H. Hart (*Econ. Geol.*, 1940, **35**, 1014—1018).—A discussion (cf. A., 1940, I, 379). L. S. T.

Spodumene pegmatites of N. Carolina. F. L. Hess (*Econ. Geol.*, 1940, **35**, 942—966).—General geology, distribution, history, and economic features are described. Details of the main pegmatites and analyses of their alkali contents are given. L. S. T.

Origin of some pegmatites in Newry, Maine. B. M. Shaub (*Amer. Min.*, 1940, **25**, 673—688).—Structural and textural characteristics of the minerals of certain pegmatites are described. The origin of the pegmatites is credited to a progressive fractionation of single injections of pegmatite magmas separated in time and space. L. S. T.

Dioptase in Arizona. F. W. Galbraith and T. H. Kuhn (*Amer. Min.*, 1940, **25**, 708—710).—Dioptase occurs in quantity at the Mammoth Mine, Pinal County. L. S. T.

Geology of the Nighthauk Peninsular gold mine. A. R. Byers (*Econ. Geol.*, 1940, **35**, 996—1011).—The ore bodies occur in or near a small stock of albite syenite, which is intrusive into andesite flows. They are carbonatised zones with disseminated pyrite (**I**) and arsenopyrite (**II**). (**I**) forms 90% of the metallic minerals, and (**II**), cobaltite, chalcopyrite, sphalerite, petzite, and Au occur in minor amounts. Gangue minerals are ankerite, and quartz with lesser sericite, fuchsite, and chlorite. Paragenesis and the origin of the deposit are discussed. L. S. T.

Cascade andesites of Oregon. R. Bogue and E. T. Hodge (*Amer. Min.*, 1940, **25**, 627—665).—The rocks of the Cascan formation of the Cascade Mountains of Oregon are made up of lavas with a diverse mineral composition. The minerals olivine, hypersthene, enstatite, plagioclases, quartz, etc. are described, and chemical analyses [G. C. Ware] of 4 rocks are recorded. The rocks were derived apparently from a magma rich in SiO_2, Na_2O, and Al_2O_3 with a composition analogous to that of dacite, and the complex mineral assemblages are best explained as a change from a dacitic magma to a basic andesite end product. Except for the plagioclases, the rocks did not follow the normal order of crystallisation.
L. S. T.

Dehydration of pollucite. M. Fleischer and C. J. Ksanda (*Amer. Min.*, 1940, **25**, 666—672).—Dehydration curves of

pollucite from Hebron, Maine, and from Elba are reproduced, and compared with the results of Strunz (A., 1937, I, 205). Dehydration commences at 300° and is complete at 640°. Microscopical and X-ray examinations of the dehydrated material show that the H_2O present in the mineral is not an essential part of the crystal lattice. The rotation powder photographs of the original and dehydrated samples are identical. The dehydrated material is partly rehydrated by heating to 400—500° with H_2O in a bomb, without the formation of clay-like alteration products.   L. S. T.

Cæsium in the pegamites of the Kalbino granites of East Kazakhstan. S. A. Borovik and I. G. Tschentzov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 252—254).—By comparison of the intensities of the Cs 8521·15 and Ba 7911·35 A. lines in the emission spectra, it has been shown that these rocks contain 0—0·4% of Cs. They also contain 0—0·5% of Rb and 0—6% of Li.   J. W. S.

Molybdenite deposits of the Rencontre East Area, Newfoundland. D. E. White (*Econ. Geol.*, 1940, **35**, 967—995).—In the Ackley City ore body, molybdenite is disseminated in altered aplite; a "honeycomb" of alteration patches has been formed by the mineralising solutions that penetrated the aplite. The origin of the aplite and the mineralisation are discussed. The Crow Cliff deposit is a pegmatic type. Chemical analyses [R. Folinsbee and R. B. Ellestad] of alaskite, aplites, muscovitised aplite, and molybdenite-aplite are recorded.   L. S. T.

Magnetite deposits near Daltonganj, Palamau district, with a note on electric smelting. K. K. Sen Gupta and J. Sen Gupta (*Quart. J. Geol. Soc. India*, 1939, **11**, 143—148). —The magnetite occurs as the midrib of a range of hills at Gore village. Estimated reserves amount to 4×10^6 tons. Chemical analyses are given. Smelting in a blast furnace is unsatisfactory, and electric smelting is recommended.   L. S. T.

Shishimskite (perovskite-spinel magnetite) from the Praskovie-Eugenievsky mine in the Shishim Mts., South Urals. L. L. Schilin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 346—349).—This ore has typically the composition magnetite and hæmatite 72%, spinel 15%, perovskite 13%. Analyses are given and compared with common titaniferous magnetite.   L. J. J.

Age of the phosphorite-bearing beds of the Kara-tau. P. L. Bezrukov, B. M. Himmelfarb, and A. S. Sokolov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 255—258).—From the forms of trilobites and brachiopods found in the lower portion of the Tamdy limestone overlying the phosphorite deposits in the Kara-tau, it is inferred that these deposits belong to the Middle Cambrian age.   J. W. S.

Laboratory tests with the water-bearing capacity on trap and associated recent rocks in the Deccan and Konkan areas. D. G. Limaye (*Quart. J. Geol. Soc. India*, 1940, **12**, 31—50). —Data for apparent and real sp. gr., H_2O content, porosity, accessible porosity, absorption of H_2O, H_2O equivs., and yield of H_2O are recorded and discussed.   L. S. T.

Zonal mineralisation and silicification in the Horseshoe and Sacramento districts, Colorado. R. D. Butler and Q. D. Singewald (*Econ. Geol.*, 1940, **35**, 793—838).—Mineralisation includes widespread recrystallisation of the pre-Pennsylvanian dolomites, less widespread replacement of dolomite by jasperoid, and deposition of ore accompanied by additional local wall rock alteration. Field and microscopical observations concerning these processes are discussed. The ores contain mainly pyrite, sphalerite, galena, tennantite, and argentite in a gangue of quartz, barite, carbonate, and recryst. and silicified country rock. Manganiferous ankerite, luzonite, chalcopyrite, and an unidentified sulphide occur locally in small amounts. These minerals exhibit zonal distribution as to mineral species, textures, and variations in composition. The zonal arrangement of the three textural types of jasperoid distinguished is significant, and reveals the finest-grained textures nearest the centre of ore deposition.   L. S. T.

Abundance and significance of cristobalite in bentonites and fuller's earths. J. W. Gruner (*Econ. Geol.*, 1940, **35**, 867—875).—X-Ray examination shows the presence of α-cristobalite (**I**) in numerous bentonites and fuller's earths from Montana, Wyoming, Colorado, Texas, Missouri, and Illinois. (**I**) is always associated with montmorillonite, and may con-

stitute up to 40% of the clay. With a decrease in (**I**) an increase in quartz (**II**) occurs, indicating that the metastable (**I**) inverts to (**II**) at some time during the history of the clay. No (**I**) has so far been found in clays older than the Cretaceous. The presence of (**I**) appears to have no detrimental effect on the properties of fuller's earth. The origin of (**I**), which is uncertain, is discussed.   L. S. T.

Time and temperature effects in the formation of colloidal dispersions. P. G. Nutting (*J. Washington Acad. Sci.*, 1941, **31**, 41—45).—The behaviour of montmorillonite bentonite digested in 0·4% HCl at 28° and at 90° is described. The solutions obtained may contain > twice the amount of SiO_2 present in a saturated solution of SiO_2 in H_2O. At 90° equilibrium is approached in 4 days, but at 28° saturation is still incomplete after 128 days. Part of the R_2O_3 leaves the clay and combines with SiO_2 to form submicroscopic colloidal particles recoverable by evaporation. The bearing of these results on the formation of clay colloids in rock cavities and soils is discussed.   L. S. T.

Occurrence of vanadium and molybdenum in clays. V. L. Bosazza (*Nature*, 1940, **146**, 746).—Many fire and building bricks made from clays of Karroo age show a greenish- or canary-yellow efflorescence after weathering. The efflorescence is sol. in H_2O, and contains V and Mo. Mo is the rarer constituent, and is best detected by heating the clay to ~1000°, extracting with hot H_2O, and crystallising the salts from the solution. H_2O-sol. material from an under-fired brick contained MoO_3 0·08, SO_3 1·01, and CaO 0·28%. V, but not Mo, is easily detected spectrographically in raw clay.   L. S. T.

Degree of dispersion of clays. IV. Shapes of clay particles. C. E. Marshall (*J. Physical Chem.*, 1941, **45**, 81—93).— Observations of dityndallism combined with those of extinction directions and birefringence in flowing clay sols enable the shape of the suspended particles to be deduced. For several clay minerals particles >100 $m\mu$. are platy and only slightly elongated. The determination of axial ratios is possible from sedimentation data and ultramicroscopical counts if the particles are regarded as flattened ellipsoids of rotation. In platy particles the larger axes lie approx. in the plane of the plates. In the birefringence experiments the Langmuir tilting effect was always observed. Only when the angle of tilt is small does dityndallism give a satisfactory indication of particle shape.   C. R. H.

Utilisation of different methods of peptising clays for the study of the mineralogical composition of their colloidal fractions. I. N. Antipov-Karataev, I. D. Sedletzki, and S. M. Jusupova (*Kolloid. Shurn.*, 1940, **6**, 133—144).—15 samples of various Turkestan clays were separated into fractions: (**I**) having particles between 2 and 0·2 μ., (**II**) with particles <0·2 μ., (**III**) with particles <2 μ. which could be peptised by N-NaCl, and (**IV**) with particles <2 μ. which could not be peptised by N-NaCl. There is little difference between fractions (**III**) and (**IV**). (**I**) have higher ratios $SiO_2 : Al_2O_3$ than (**II**). X-Ray patterns indicate a different mineralogical composition of (**I**) and (**II**), e.g., halloysite and quartz in (**I**) and montmorillonite in (**II**), or quartz and nacrite in (**I**) and muscovite and saponite in (**II**). The results of thermal analysis are less clear.   J. J. B.

Granulometric composition of sands as an index of the conditions of their deposition. L. B. Ruchin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 522—524).—Sands deposited under different conditions can be distinguished. Errors involved in the method are indicated.

Genesis of setting loess-like loams. N. J. Denisov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **28**, 525—526).

Coral reefs and the formation of petroleum. W. Bergmann and D. Lester (*Science*, 1940, **92**, 452—453).—Coral reefs must be regarded as storehouses of compounds which may be potential precursors of petroleum. $COMe_2$ extracts of staghorn coral (*Madrepora cervicornis*) yield cetyl palmitate (0·25% of the original coral). The non-saponifiable fraction (0·25% of the total) yielded sterols pptd. by digitonin, non-steroid alcohols [mainly cetyl alcohol (**I**)], and hydrocarbons and ketones. *Meandra areolata* contains ~0·3% of non-saponifiable material consisting of cholesterol, an unknown sterol, (**I**), hydrocarbons, and possibly ketones. The calcareous outside layers of the sea-fans contain ~3% of non-saponifiable material.   L. S. T.

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