

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

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

JANUARY, 1942.

I.—SUB-ATOMICS.

Hyperfine structure in the arc spectrum of tin. S. Tolansky and G. O. Forester (*Phil. Mag.*, 1941, [vii], 32, 315—323; cf. A., 1934, 823).—From measurements on the spectrum excited by a hot hollow-cathode discharge, data are reported for $\lambda\lambda$ 3352, 2832, 5632, 3223, *3034, 3009, *2863, and 2762, where * denotes reversal. The last six are classified, analysed, and discussed in detail, and interval factors are derived for 7 terms including the complete group belonging to the deep $5p^3$ electron configuration. The nuclear coupling of this group is large, in agreement with deductions on the coupling of the $5p^4$ group in I. A J -val. is allocated to one term. The two odd isotopes 117 and 119 have nuclear spins $\frac{1}{2}$ and identical nuclear magnetic moments. No even isotope displacements were observed, and observations on reversals show that any such existing must be very small. N. M. B.

Polarisation of some spectral lines excited by low-speed electrons in a discharge tube containing mercury or mercury-cadmium amalgam as anode. B. N. Ghosh (*Current Sci.*, 1941, 10, 325—326).—60-v. electrons were allowed to impinge on the surface of Hg or 2% Cd amalgam at 130°. The depolarisation of the 5791, 5770, and 5461 Å. Hg lines was increased by the Cd, and rendered complete by a transverse magnetic field of 100 gauss applied to the discharge zone. A. J. E. W.

Transient discharges in mercury [vapour] at high pressures. R. Rompe and P. Schulz (*Physikal. Z.*, 1941, 42, 105—110).—The production of periodic discharges of very high intrinsic brilliancy and short duration ($\sim 5 \times 10^{-6}$ sec.) is described. The discharge is established in a gap between two activated W electrodes in a heated bulb containing an inert gas and Hg vapour at 1—6 atm. pressure (p); the transient illuminating power (i), with an energy input of ~ 70 w.-sec. per discharge, is $\sim 1.2 \times 10^7$ c.p. The effects of peak voltage (> 20 kv.) and p on i and the max. discharge current ($> 60,500$ amp.) are examined, and the spectrum of the discharge is shown. A. J. E. W.

Zeeman effect data and further classification of the first spark spectrum of cerium, Ce II. G. R. Harrison, W. E. Albertson, and N. F. Hosford (*J. Opt. Soc. Amer.*, 1941, 31, 439—448).—Data are recorded for the Ce II spectrum over the range 2500—7000 Å., photographed in magnetic fields up to 96,400 oersteds, g and J vals. are determined for 280 levels. The energy system of Ce II consists of a lower group of levels $4f^26s$, $4f^25d$, $4f^26p$ and $4f^3$, and a higher group $4f5d6s$, $4f5d^2$, $4f5d6p$, $4f6s6p$. Interactions of the levels are strong. The g sum rule is found to be exact when all perturbing terms are known. L. J. J.

Zeeman effects in the palladium spectrum. C. H. Lindsley and N. Rosen (*J. Opt. Soc. Amer.*, 1941, 31, 531—533).—Data for 37 Pd I and 127 Pd II lines are recorded, measured in a field of $\sim 87,500$ gauss. g vals. for levels arising from $4d^95s$ and $4d^95p$ for Pd I and $4d^85s$ and $4d^85p$ for Pd II are given. L. J. J.

Useful X-ray data. E. W. Pike (*J. Appl. Physics*, 1941, 12, 206—209).—The measured mass absorption coeffs. of Allen and Wrede for H, Be, C, N, O, F, Na, Al, Si, Cl, and Br have been fitted to $\mu/\rho = a\lambda^n + c/(1 + 0.048/\lambda)$ by least squares and the vals. of a , n , and c tabulated. The energy distribution in the continuous X-ray spectrum from 20 to 70 kv., as measured by Kirkpatrick and by Ulrey, has been recomputed and presented graphically. D. F. R.

X-Ray physics and X-ray tubes. V. Hicks (*J. Appl. Physics*, 1941, 12, 364—373).—A review dealing with the nature of the

X-ray spectrum (continuous and line), absorption of X-rays, and the measurement of X-ray intensity. The design and manufacture of X-ray tubes for various purposes, and of valve tubes, are also described. A. J. M.

Spectral and total thermal emissivities of oxide-coated cathodes. G. E. Moore and H. W. Allison (*J. Appl. Physics*, 1941, 12, 431—435).—The emissivities of oxide-coated cathodes of the uncombined type, such as are used in valves for telephone repeaters and radio receivers, have been determined. The spectral emissivity of the type of coating used on equipotential cathodes was determined at 0.65 μ , in the temp. range 900—1200° K., using the tubular-filament method, and the results were checked by the diffuse reflectometer method of Prescott *et al.* (A., 1939, I, 51, 159). The latter method was also used with filament cathodes, and the determination was extended to room temp. There is no variation of spectral emissivity with temp. A. J. M.

Photon counters for spectral investigations in the ultra-violet. M. N. Djatschenko (*J. Physics U.S.S.R.*, 1940, 3, 479—486).—The construction of photon counters with polished Al cathodes is described. The spectral distribution of the ultra-violet fluorescence of rock-salt excited by X-rays has been investigated by means of a three-electrode counter, in which a grid between the cathode and anode allows analysis of the energy distribution of the emitted photoelectrons. O. D. S.

The electronic charge. V. D. Hopper and T. H. Laby (*Proc. Roy. Soc.*, 1941, A, 178, 243—272).—The determination was carried out by a new oil-drop method. The drop first falls under gravity between two vertical plane electrodes and is then deflected by the application of a horizontal electric field. The fall of the drop is recorded photographically by intermittent illumination. The main error arises from uncertainty of the val. of the viscosity of air; the result agrees within the limits of error with the val. found from X-ray data. G. D. P.

Evaluation of the Avogadro number, N , and the charge on the electron, e , by X-rays. J. A. Bearden (*J. Appl. Physics*, 1941, 12, 395—403).—X-Ray methods can give more exact information about the physical constns. N , e , h , and m than any other available method. The determination of the λ of X-rays by diffraction methods is described. The grating const. of calcite crystals has been obtained by comparison of crystal and grating λ , and can also be obtained from chemical data. For calcite $d = (M/2N\rho\phi)$ where M = mol. wt., ρ = density, ϕ = vol. of a rhombohedron the perpendicular distance between the opposite faces of which is l . N can be calc. from this, the val. on the physical scale of at. wts. being $(6.0245 \pm 0.0004)10^{23}$. The val. of e deduced from this is $(4.8024 \pm 0.0006)10^{-19}$ e.s.u., but its accuracy is limited by that of the Faraday. A. J. M.

Electrostatic cylindrical electron lenses. A. M. Straschevitch (*J. Physics U.S.S.R.*, 1940, 3, 507—523).—Mathematical. The potential fields of electron optical systems with a narrow slit in a plane or cylindrical electrostatically charged diaphragm are investigated. Formulæ are derived for the focal lengths of cylindrical electron lenses based on similar arrangements. O. D. S.

Structure of gas discharges. H. Raether (*Naturwiss.*, 1940, 28, 749—750).—Two types of gas discharge are recognised, the Townsend structure and the canal structure. In the Townsend type the increase of current with time is determined by ionic mobility. In the canal structure the first burst of electrons to leave the cathode produces such an intense field at its head that the discharge proceeds rapidly towards the

anode in a canal form. An even more rapid canal discharge is then developed towards the cathode. The conditions under which the canal type of discharge occurs are examined. The Townsend structure predominates for $pd < 1000$ torr cm., and the canal structure for $pd > 1000$ (p = pressure, d = distance between electrodes). The vals. of the static breakdown field strength for $pd > 1000$ are compared with the calc. vals. The dependence of the time required for building up the discharge on the excess of the applied potential above the static potential for breakdown is investigated.

A. J. M.

Cathode drop of an arc. G. H. Fett (*J. Appl. Physics*, 1941, 12, 436—438).—The cathode drop of an arc has been measured for Cu, Fe, Ag, Pt, and steel electrodes, and arc welding electrodes, with and without coatings. The time for an arc to establish the cathode-drop voltage measured from the time the last contact causes an appreciable voltage drop is $< 40 \mu\text{-sec.}$ For an arc between Cu electrodes in air, the voltage across the contacts at the instant of separation is independent of the current in the range 0.5—10 amp., independent of the open circuit voltage after the arc was extinguished in the range 8—230 v., and also of the circuit parameters and speed of separation of the contacts. It varies with the pressure of the atm. in which the arc is burning. For Cu the drop decreases from 13 v. at atm. pressure to 8 v. at 0.1 mm. The drop depends on the nature of the electrodes and, in the case of welding electrodes, on the coating, if any.

A. J. M.

Production of large ionic currents. II. M. I. Korsunski and S. T. Shavlo (*J. Physics U.S.S.R.*, 1940, 3, 385—392).—Conditions have been examined for the formation of ions due to ionisation by electrons in a gas at such pressures that the free path of the electron is $>$ the distance between the electrodes. The dependence of the ionic current on potential at const. pressure, accelerating potential and grid potential, and the dependence on gas pressure, have been determined. The effect of pressure on ionic current is complicated; there exists a limiting pressure above which it is possible to get a very large ionic current. In the neighbourhood of this the discharge becomes very unstable. There is an oscillatory motion of electrons between the electrodes. With suitable parameters, the probability of ionisation is so great that the no. of ions generated per electron is > 1 .

A. J. M.

Theory of anode fall in glow discharges. A von Engel (*Phil. Mag.*, 1941, [vii], 32, 417—426).—A theory is developed which relates to the processes occurring in the neighbourhood of the anode when a positive column is present. The factors which determine the dependence of anode fall on discharge current are studied. The theory is verified by previous data for discharges in H_2 , D_2 , N_2 , O_2 , He, Ne, and Ar.

A. J. E. W.

Theory of non-stationary states of the electric discharge plasma. B. Granovski (*J. Physics U.S.S.R.*, 1940, 3, 195—218).—Mathematical. Schottky's diffusion theory is generalised to include non-stationary states of the plasma in low-pressure discharges of low and medium frequency.

L. J. J.

Temperature of the ionosphere. R. Penndorf (*Naturwiss.*, 1940, 28, 751).—The temp. of the F_2 layer is 500—1000° K. according to the composition of the air. The temp. of the E layer where the N_2 is not dissociated and the O_2 is beginning to dissociate is 330—374° K. The temp. of other parts of these layers are calc. on the basis of the different composition of the air.

A. J. M.

Recoil-electron spectrum of γ -rays from radium-C. G. D. Latschev, A. F. Kompaneetz, N. P. Borisov, and I. M. Gusak (*J. Physics U.S.S.R.*, 1940, 3, 251—262).—A method of analysing energies of recoil electrons is developed; it consists essentially of a magnetic spectrograph with two Geiger-Müller counters for recording the electrons by the coincidence method. The method is applied to the examination of the recoil-electron spectrum of Ra-C. The energy spectrum shows a no. of peaks. Comparison with the internal conversion positron spectrum indicates that the relative intensities of the γ -lines of Ra-C obtained from the positron spectrum and the recoil-electron spectrum are the same. The theoretical curve calc. from Jaeger and Hulme's theory (A., 1935, 557) which gives the dependence of the internal conversion coeff. on the γ -ray energy for quadripole

transitions is verified. The principal hard γ -lines of the Ra-C spectrum are of quadripole origin.

A. J. M.

Positron spectrum of radium-C. A. I. Alichanov and G. D. Latschev (*J. Physics U.S.S.R.*, 1940, 3, 263—274).—The positron spectrum of Ra-C has been investigated with improved apparatus. The curve of energy against no. of positrons shows 11 sharp drops, each corresponding with a γ -line of which the energy can be calc. All the positrons from Ra-C arise from internal conversion of γ -rays. It is shown that the total intensity of a large no. of γ -lines of Ra-C is comparable with the intensity of the strongest γ -line of Ra-C. The theory of Jaeger and Hulme (A., 1935, 557) is verified. No drop corresponding with energy of 1414 ke.v. of a nucleus level in Ra-C' has been observed, in agreement with the fact that a transition from this level with emission of a γ -ray is forbidden.

A. J. M.

Radioactive thallium isotope thorium-C''. J. Zirkler (*Z. physikal. Chem.*, 1940, A, 187, 103—104).—Measurements of the coeff. of partition of Th-C'' between Th' and Th'' at 50° give the same result as at lower temp., whence it appears that the effect is not due to ion hydration. It was previously suggested (cf. A., 1936, 282, 791) that the distribution is determined by the mass-ratio of the Tl isotopes. The mean of 12 experiments gives for this ratio $^{203}\text{Tl}/^{205}\text{Tl} = 29.5/70.4$, in agreement with the mass-spectrograph result. F. L. U.

Scattering of photo-neutrons by nuclei. A. I. Leipunski (*J. Physics U.S.S.R.*, 1940, 3, 231—236).—Dunning's result (A., 1934, 714) that the scattering cross-section of photo-neutrons increases smoothly from element to element with increasing at. wt. is due to the use of a detector sensitive only to high-energy neutrons. Experiments on the scattering of neutrons obtained by bombarding Be and D with γ -rays from Ra and Ra-Th with a more sensitive detector show that the cross-section varies irregularly from element to element. Neutrons of energies 130, 220, and 900 ke.v. were used. For light elements (H—Ca) sharp max. are found in the curve of scattering cross-section against neutron energy, pointing to the existence of resonance levels. These effects explain the irregular variation of cross-section. For heavy nuclei (Mn—Bi) the curve falls regularly as neutron energy increases, agreeing with the statistical theory of nuclei. The variation of cross-section for these elements is connected with some individual property of the nucleus. The variation of cross-section of thermal neutrons in the case of heavy elements depends largely on the existence of levels in the nucleus near the thermal energy. In those cases where resonance levels have not been observed, or where they lie far from the thermal region, it is possible that there are levels with energies slightly $<$ the capture energy of a neutron by the nucleus.

A. J. M.

Isomerism of atomic nuclei. L. I. Rusinov and A. A. Jusefovitch (*J. Physics U.S.S.R.*, 1940, 3, 281—286).—The β - and γ -transformations of the radioactive ^{80}Br nucleus are considered. Each β -transition is accompanied by the evolution of a soft electron, supposed to be an electron of internal conversion. This hypothesis requires the emission of X-rays in the process of decay of radioactive Br, and these were detected. This confirms the theory of Bohr and Weizsäcker that isomerism of nuclei is due to different (metastable) energy states of the nuclei. A suggested scheme of transitions of isomeric Br is given. To establish the theory completely it is necessary to show experimentally that the small probability of transition of the nucleus from the metastable to the ground state is due to the great difference of angular momenta corresponding with the levels. Experimental data are at present insufficient to prove this, but it is known that in the 48-ke.v. transition of the nucleus from the metastable level the change in the angular momentum is at least 2 units.

A. J. M.

Radiations from bromine (^{82}Br). J. Rotblat (*Nature*, 1941, 148, 371—372).—The radioactive Br was prepared by irradiating a thin layer of Se evaporated on Au foil with 4-Me.v. protons from a cyclotron. The β -ray absorption curve indicates that the β -radiation from ^{82}Br consists of two groups with 97% of the disintegrations having an upper energy limit of 460 ± 10 ke.v., and 3% having an upper limit of 1200 ± 50 ke.v. Absorption of the γ -rays in Pb and Al gives a two-component curve, indicating the existence of two γ -quanta of ~ 700 and 1300 ke.v., the former being twice as intense as the latter. Absorption of Compton electrons

showed the existence of a γ -ray line of 1250 ± 50 ke.v., with a second component of 700 ± 50 ke.v. The intensity of the softer γ -quantum is twice that of the harder. The rate of β - γ coincidences is 4.88 ± 0.07 per 1000 β -rays, and that of γ - γ coincidences, 3.14 ± 0.07 per 1000 γ -rays. Hence the γ -rays following the emission of the main group of β -rays form a cascade of 3 quanta per disintegration. A nuclear level scheme of ^{82}Kr and ^{82}Br representing these results is given. The total disintegration energy of ^{82}Br is 3.1 Me.v.

L. S. T.

Artificial radioactivity. V. K. Diebner and E. Grassmann (*Physikal. Z.*, 1940, **41**, 157—194; cf. A., 1939, I, 294).—A detailed review of work published in 1939. A. J. E. W.

Deuteron-tritium reaction in fluorine. R. S. Krishnan (*Nature*, 1941, **148**, 407—408; cf. A., 1941, I, 360).—Bombardment of NaF with 9-Me.v. deuterons, and a LaF₃ separation from the irradiated sample, give a fluoride fraction which shows, in addition to a short-period activity, an intense positron 112 ± 2 -min. activity. The absorption limit obtained for the positron spectrum is 0.23 ± 0.01 g. per sq. cm. of Al, corresponding with a max. energy of 0.72 ± 0.02 Me.v. ^{18}F is thus formed by the reaction $^{19}\text{F}(\text{d}, ^3\text{H})^{18}\text{F}$. Excitation function measurements, made by the powder technique, indicate a threshold at ~ 6 Me.v., and a Q val. of -3.2 Me.v. for this reaction. The cross-section for the formation of ^{18}F from F under deuteron (8.8-Me.v.) bombardment is $3.9 \pm 0.4 \times 10^{-27}$ sq. cm. L. S. T.

Spontaneous fission of uranium. G. N. Flerov and K. A. Petrshak (*J. Physics U.S.S.R.*, 1940, **3**, 275—280; cf. A., 1940, I, 338).—A special type of tuned ionisation chamber has been constructed, and is used in conjunction with an amplifier for the investigation of ionisation produced by fission products of U. The sensitivity is 30—40 times that of an ordinary chamber. The fission of U nuclei in the absence of a neutron source has been verified. It is probably to be explained by the spontaneous fission of ^{238}U nuclei of half-life 10^{16} — 10^{17} years. A. J. M.

Angular distribution of shower particles. L. Landau (*J. Physics U.S.S.R.*, 1940, **3**, 237—242).—The total no. of all particles in a shower is given by an exponential factor previously calc. (A., 1938, I, 424) and a non-exponential coeff. The latter is calc., and an expression is obtained for the max. no. of particles in a shower. An expression for the angular distribution of particles in a shower is also deduced. The mean horizontal width of a shower at a given level is obtained. The width is almost independent of the path traversed by the shower and of the kind of particle generating it. In air the width is ~ 250 m. A. J. M.

(A) General classical theory of spinning particles in a Maxwell field. H. J. Bhabha and H. C. Corben. **(B) General classical theory of spinning particles in a meson field.** H. J. Bhabha (*Proc. Roy. Soc.*, 1941, **A**, 178, 273—314, 314—350; cf. A., 1940, I, 309).—(A) A complete classical theory of a spinning particle moving in a Maxwell field is given. The equations are consistent with the conservation of energy, momentum, and angular momentum, and thus contain the effect of radiation reaction on the motion of the particle.

(B) An exact theory of the motion of a point dipole in a meson field is given which takes into account the effects of the reaction of the emitted meson field. G. D. P.

Meson theory. D. Ivanenko (*J. Physics U.S.S.R.*, 1940, **3**, 417—419).—The meson theory explains the isotopic displacement of the spectra of certain elements which remains after the motion of the nucleus has been taken into account, since the meson theory leads to interaction between all elementary particles and not only between heavy nuclons. There will thus be an interaction between neutrons and electrons which explains not only the isotopic displacement but also the anomalous scattering of electrons by nuclei, observed by Bothe. The scattering of mesons due to their interaction with quasi-magnetic moments of neutrons is considered. A. J. M.

Problem of two plane waves in classical non-linear electrodynamics. A. A. Smirnov (*J. Physics U.S.S.R.*, 1940, **3**, 447—453).—Mathematical. The properties of a plane monochromatic light wave in space in which another plane monochromatic light wave is propagated are investigated according to the classical non-linear electrodynamics of Born and Infeld (A., 1935, 912). On the assumption that the fields of

the waves are small compared with the crit. field, the solution is obtained in a first-order approximation showing that both a distortion of the fields of the initial waves, and the appearance of scattered waves with greatly changed frequencies and velocities of propagation, will occur. The effects are very small and unobservable experimentally. O. D. S.

Connection of the quantum ensemble with the Gibbs classical ensemble. II. D. Blochintzev and P. Nemirovski (*J. Physics U.S.S.R.*, 1940, **3**, 191—194; cf. *ibid.*, 2, 71).—Mathematical. The conditions for the approximation of quantum statistics by classical statistics are discussed. L. J. J.

II.—MOLECULAR STRUCTURE.

Band spectrum of thallium bromide. H. G. Howell and N. Coulson (*Proc. Physical Soc.*, 1941, **53**, 706—713; cf. A., 1938, I, 431). Data and classifications of the bands of TlBr photographed in absorption and in emission for 3400—4500 Å. are reported. An expression for the analysis of the main band system $1 \rightleftharpoons ^1\Sigma^+$ is found. A very small but intense band system occurs, in emission only, at 3950 Å.; the lower state is the upper state of the main system. Predissociation occurs in both systems and the unstable levels responsible are the upper levels of continua at 1900 and 3300 Å. Other continua occur at 2700 and 2960 Å. N. M. B.

Perturbations in the neighbourhood of the predissociation limit. B. I. Stepanov (*J. Physics U.S.S.R.*, 1940, **3**, 463—466; cf. A., 1941, I, 147).—Theoretical. The existence of small perturbations in the predissociation levels is attributed to interaction with both continuous and discrete levels. Theoretical predictions agree with observed perturbations near the predissociation limit in the spectra of CaH, N₂, Se₂, and S₂. O. D. S.

Spectroscopic observation on hydrocarbon flames in atomic oxygen. I. K. H. Geib and W. M. Vaidya. **II. Spectroscopic investigation of hydrocarbon flames.** W. M. Vaidya (*Proc. Roy. Soc.*, 1941, **A**, 178, 351—355, 356—369).—I. Flames of hydrocarbons burning in at. O were examined to see whether the C₂H₄ flame bands occur. They are found to be strong in C₂H₆ and C₂H₂, but weak and diffuse in C₂H₄. MeOH gives OH and CH bands and also "cool flame" bands, whilst CH₃O shows only the OH band at $\lambda 3064$. The C₂H₄ flame bands are not observed in the flame of C₆H₆ burning in at. H.

II. The materials examined include CH₄, C₂H₄, C₂H₂, and the intermediate products of their combustion, viz., MeOH, CH₃O, HCO₂H, MeCHO. The flames of the Bunsen and Méker burners were also examined and some observations were made on Et₂O, EtOH, MeCl, CHCl₃, and CCl₄. In general the outer cones give a spectrum identical with the CO flame spectrum whilst the inner cones show C₂, CH, OH, and the C₂H₄ flame bands. Prevalent theories of hydrocarbon combustion are discussed in the light of the spectroscopic evidence. G. D. P.

Infra-red absorption spectrum of acetone. D. Price (*J. Chem. Physics*, 1941, **9**, 725—726).—The infra-red absorption spectrum of gaseous COMe₂ has been measured over the frequency range 500—3000 cm.⁻¹, using CaF, NaCl, and KBr prisms, and 13 frequencies are recorded. J. W. S.

Sensitised chemiluminescence in solutions. B. Tamamushi (*Naturwiss.*, 1940, **28**, 722—723).—An intense blue glow is observed when luminol (3-aminophthalhydrazide) is oxidised in alkaline solution in the presence of haemin as catalyst. If a fluorescent substance is added to the reaction mixture the colour of the glow is that of the fluorescent substance. This is an example of chemifluorescence, in which the fluorescence is excited not by external light but by the energy of the reaction in the solution. There are two possible explanations represented by the following schemes: (1) $L + \epsilon \rightarrow L^*$, $L^* \rightarrow L + h\nu$, $F + h\nu \rightarrow F^*$, $F^* \rightarrow F + h\nu'$; (2) $L + \epsilon \rightarrow L^*$, $L^* + F \rightarrow L + F^*$, $F^* \rightarrow F + h\nu'$ (L = luminol, F = fluorescent substance). The second is a case of sensitised chemiluminescence, and is the more probable, since the addition of another chemiluminescent substance, dimethyldiacridylum nitrate, to a mixture of luminol and haemin gives the luminescence of the former and not of the latter, and with greater intensity. A definite concn. of fluorescent substance is required to extinguish the blue luminescence of luminol, but

as the concn. of the fluorescent substance is increased the luminescence due to it decreases in intensity and is ultimately completely extinguished. A. J. M.

Elementary oscillators and polarisation of photoluminescence. S. I. Vavilov (*J. Physics U.S.S.R.*, 1940, 3, 433—442).—Theoretical. The polarisation of photoluminescence, and its dependence on the orientation of the electric vector of the absorbed light and of the direction of observation, are uniquely determined by the multipole order of the absorbing and scattering radiators, provided that the anisotropy of the absorbing system is not completely destroyed by collision or other causes before radiation. The polarisation distribution is calc. for linear oscillators, for the cases in which the absorbing and scattering radiators are respectively: dipole, dipole; quadrupole, quadrupole; dipole, quadrupole; and quadrupole, dipole. O. D. S.

Extinction of the fluorescence and photothermal decomposition of aniline. A. Vartanian (*J. Physics U.S.S.R.*, 1940, 3, 467—478).—The extinction of the fluorescence of NH_2Ph vapour at 3 mm. pressure by O_2 , NH_3 , and H_2 has been studied. The pressures at which fluorescence is halved are 8 mm., 90 mm., and 250 mm. respectively for these gases. The high quenching efficiency of O_2 is due to chemical reaction. When NH_2Ph vapour is superheated at temp. up to 400° and const. pressure (3 mm.) the fluorescence decreases linearly with temp. after correction has been made for the decrease in density with temp. At these temp. irradiation with the Mg spark, after filtering out the 2026 Å. line, decomposes NH_2Ph giving NH_3 , H_2 , a substance or substances fluorescing in the visible, and solid products. The reaction is interpreted as a unimol. decomp. due to a chance accumulation at the bond (which is ruptured) of thermal energy sufficient to cause decomp. of the excited mol. O. D. S.

Concentrational depolarisation of the fluorescence of dye solutions. P. P. Feofilov and B. J. Sveschnikov (*J. Physics U.S.S.R.*, 1940, 3, 493—505).—The variation with concn. of the polarisation of the fluorescence of glycerol solutions of Na fluorescein, eosin, rhodamine-B (I), and trypanflavin (II) has been studied in the presence of varying concns. of quenching agents (NHP_2 and KI). As the quenching increases, polarisation of the fluorescence increases, tending to a const. val. for all concns. of the fluorescing mol., i.e., concentrational depolarisation is diminished by a shortening of the life-time τ of the excited state by quenching. The dependence of the polarisation of the fluorescence of (I) on temp. confirms that concentrational depolarisation decreases with increased quenching, in this case due to the rise in temp. The complicated form of the depolarisation curve of (II) is ascribed to the balancing effects of concentrational depolarisation and the increase in polarisation due to the shortening of τ by concentrational quenching. Perrin's theory, which ascribes concentrational depolarisation to resonance transfer of energy between excited and normal dyestuff mols., is regarded as the most satisfactory interpretation of the phenomena. O. D. S.

Raman spectra of mono- and di-chlorobenzenes. H. Sporer and J. S. Kirby-Smith (*J. Chem. Physics*, 1941, 9, 667—672).—Raman spectral data for gaseous PhCl and *o*-, *m*-, and *p*- $\text{C}_6\text{H}_4\text{Cl}_2$ and depolarisation factors for the Raman lines of liquid *o*-, *m*-, and *p*- $\text{C}_6\text{H}_4\text{Cl}_2$ are recorded. Assignments which include most of the lines in the gas are suggested. J. W. S.

Raman spectrum of di-tert.-butyl ether. F. F. Cleveland (*J. Chem. Physics*, 1941, 9, 722—724).—Raman displacements, estimated intensities, and depolarisation factors for liquid Bu_2O are recorded, and compared with similar data for Bu^n_2O and Bu^m_2O (A., 1940, I, 195). The observed displacements are assigned tentatively. J. W. S.

Relation between absorption spectra and chemical constitution of dyes. XIX. Mono- and poly-azo-dyes with a single auxochrome.—See A., 1942, II, 8.

Ionisation potentials of polyatomic molecules. T. M. Sugden, A. D. Walsh, and W. C. Price (*Nature*, 1941, 148, 372—373).—The following vals. are recorded for first ionisation potentials: H_2O 12.56, MeOH 10.8, EtOH 10.7, PrOH 10.7, Me_2O 10.5, Et_2O 10.2, H_2S 10.42, MeSH 9.7, Me_2S 9.4, Et_2S 9.3, Pr_2S 9.2; NH_3 10.8, NH_2Me 9.8, NHMe_2 9.6, NMe_3 9.4; CH_2O 10.83, MeCHO 10.181, COMe_2 10.1, $\text{CH}_2\text{CH-CHO}$ 10.06, PrCHO 10.19; CMe:CH 11.25, $(\text{CH}_2\text{C})_2$

10.74; $\text{CH}_2\text{:CHCl}$ 9.95, $(\text{CHCl})_2$ 9.61 (*cis*), 9.91 (*trans*); C_6H_6 9.19, anthracene 8.3, PhMe 8.77, xylene (*o*-, *m*-, and *p*-) ~8.3 e.v. Vals. given to 0.01 v. are spectroscopic, the others are electron impact vals. For H_2O , H_2S , CH_2O , and their alkyl derivatives, the electron removed is a non-linking $p\pi$ O (or S) electron. For NH_3 and the amines, the min. ionisation potential corresponds with a $2p_z(\pi)$ electron, which is non-linking with orbital perpendicular to HHH plane. In CMe:CH , $(\text{CH:C})_2$, the halogenoethylenes, and the aromatic mols., π electrons of the double and triple linkings are involved. For MeCHO , $\text{CH}_2\text{CH-CHO}$, and CHMe:CH-CHO , extensive Rydberg series were found in the vac. ultra-violet, giving limits (ionisation potentials) of 10.1811 ± 0.0007 , 10.057 ± 0.006 , and 10.187 ± 0.001 v., respectively. L. S. T.

Breakdown potentials in hydrogen, oxygen, nitrogen, nitric oxide, hydrogen chloride, hydrogen bromide, and hydrogen iodide. G. M. Kovalenko (*J. Physics U.S.S.R.*, 1940, 3, 455—462).—Breakdown potentials have been measured in H_2 , O_2 , N_2 , NO , HCl , HBr , and HI at a const. ratio of pressure to abs. temp., i.e., with const. no. of mols. per c.c. of gas. Some data are given for the variation in breakdown potential with the no. of discharges previously made through the gas. The correlation of breakdown potential with the mol. wt., mean free path, ionisation potential, crit. temp., interat. distance, and heat of dissociation of the mol. is discussed. O. D. S.

Effect of X-rays on the breakdown strength and flashover voltage of certain dielectrics. E. A. Walker (*J. Appl. Physics*, 1941, 12, 215—218).—Measurements of the reduction in breakdown strength of air, insulating oil, and yellow varnished cambric are given. The flashover voltage at a solid/air boundary increases slightly on exposure to X-rays. D. F. R.

Electric strength of gases. A. M. Bontsch-Bruevitsch, M. B. Glinka, and B. M. Hochberg (*J. Physics U.S.S.R.*, 1940, 3, 327—332).—The electric strength of a no. of gases, chiefly F compounds (e.g., SOF_2 , SO_2F_2 , SF_6 , PF_5 , BF_3 , CCl_2F_2 , CCl_3F , CF_4 , and SiF_4) has been determined. There is no simple relationship between electric strength and ionisation potential or no. of atoms in the mol. Electric strength increases with increasing mol. wt. but no definite connexion between these can be traced. A. J. M.

Electrical conductivity of semi-conductors with an ionic lattice in strong fields. B. Davidov and I. Schmushkevitch (*J. Physics U.S.S.R.*, 1940, 3, 359—377).—Theoretical. The deviations from Ohm's law of electronic semi-conductors with an ionic lattice in a strong field are investigated. In addition to the interaction of electrons with the optical vibrations of the lattice, inelastic collisions (ionisation) must be taken into account. The mean energy of the electrons approaches 0.2 of the ionisation energy with increasing field, so that, unlike semi-conductors with an at. lattice, the electron mobility increases in the case of ionic lattices, in strong fields. The variation of mobility with field strength and temp. is different for low and high temp. The boundary dividing the ranges is $\theta = \hbar\omega_0/k$ (ω_0 is the limiting frequency of optical vibrations of the crystal). For $T < \theta$ and fields up to ~1000 v. per cm., the mobility is independent of the field, and Ohm's law holds; the mobility decreases exponentially with T . At $T > \theta$ and fields $< 10^5$ v. per cm. the conductivity is independent of the field and varies as $T^{-\frac{1}{2}}$. For fields $> 10^5$ v. per cm. the conductivity increases with the field. Frohlich's theory of breakdown is discussed. A. J. M.

Theory of anomalous dispersion and dielectric losses in solids. W. Holzmüller (*Physikal. Z.*, 1940, 41, 499—508).—Dielectric losses in polar solids are due to changes in the orientation of the polar groups among the various positions of min. energy; these changes occur by the combined action of thermal collisions and the electric field, and are therefore time-dependent. By introduction of certain relaxation times the dependence of ϵ and loss angle (δ) on frequency and temp. is explained, and ϵ and δ are related to the mean motion of the polar groups and their polarisability. A. J. E. W.

Variation of dipole moment of ethylene bromide and ethylene chloride with temperature. R. Linke (*Z. physikal. Chem.*, 1940, B, 46, 251—260).—Assuming the equilibrium between *cis*- and *trans*-forms to be a function of temp., the dipole moments of the *cis*-forms of $(\text{CH}_2\text{Br})_2$ and $(\text{CH}_2\text{Cl})_2$ have been calc. from the variation of the dipole moments of the equilibrium mixtures with temp. The dipole moments of monohalogeno-

derivatives are not greatly different from those of the dihalogeno-compounds. A. J. M.

Variation of dipole moment of *o*-chlorophenol with temperature, and the dipole moments of *p*-chlorophenol, *o*-anisidine, and the phenylenediamines. R. Linke (*Z. physikal. Chem.*, 1940, B, 46, 261—269).—The dipole moment of *o*-C₆H₄Cl·OH varies with temp., but that of the other substances mentioned above does not. It is assumed that in the case of *o*-C₆H₄Cl·OH there is *cis-trans* isomerism, and the effect of temp. on the dipole moment is used to calculate the heat of transformation, which is 1200±500 g.-cal. The particularly large effect of the substituents in this mol. on the moment is considered to be due to the occurrence of a H bond, and the effect of the CO linking on the position of the H atom; this is confirmed by considering the moments of *o*-C₆H₄Cl·NH₂ and *o*-anisidine. In the case of *o*-C₆H₄(NH₂)₂ there is a considerable difference between the observed moment and that calc. on the assumption of free rotation. In the case of the *m*- and *p*-compounds there is free rotation. A. J. M.

Dipole moment in solution. G. R. Paranjpe and D. J. Davar (*Indian J. Physics*, 1941, 15, 173—183).—The apparent electric moments of *o*-, *m*-, and *p*-C₆H₄Me·NO₂ have been measured at 30° in C₆H₁₄, C₂H₆, CCl₄, C₆H₆, PhMe, CS₂, and CHCl₃. The results are used to verify the empirical relations of Müller, Sugden, and Jenkins and the theories of Frank and Higasi connecting the measured moment with its val. in the gaseous state. Extrapolation to $\epsilon = 1$ for the gaseous state does not lead to concordant vals. but extrapolation to $\epsilon = 1.7$ leads to general agreement between the vals. derived from the various proposed relations. W. R. A.

Refractive index of lithium fluoride in the visible and infra-red regions. H. Littmann (*Physikal. Z.*, 1940, 41, 468—475; cf. Hohls, A., 1937, I, 402).—Vals. of n_F , n_D , and n_C at 21°, correct to ~2 p.p.m., are recorded for an artificial LiF prism. Vals. of n (±10—20 p.p.m.) at 1.0—3.0 μ , referred to the dispersion curve of quartz, are derived from dispersion measurements against the C-line. The temp. coeff. of n_D is also determined to ±0.1 p.p.m. A. J. E. W.

Absorption of light and heat radiation by small spherical particles. I. Absorption of light by carbon particles. R. Ruedy (*Canad. J. Res.*, 1941, 19, A, 117—125).—Mie's theory of scattering by small spherical particles leads to an expression whereby the absorption by small C particles (lamp-black), of diameter comparable with λ of incident light, can be calc. When the diameter is <0.2 μ , the coeff. of absorption decreases towards the red and a cloud of such particles appears red or blue by transmitted or scattered light, respectively; for particles of diameter 0.3 and 0.4 μ , the reverse holds, but the % change is small. A. A. E.

Theory of the Plotnikov effect. T. Neugebauer (*Physikal. Z.*, 1940, 41, 55—62).—The theory, which gives results in approx. agreement with experimental data, is developed for long-chain polymerides on the assumption that the effect is due to refraction and total reflexion at the boundaries of the macromols.; the type of process occurring at each boundary is determined by the orientation of the chain to the plane of polarisation of the incident infra-red beam. "Scattering reflexion" of the beam is due to multiple processes of the same nature, and depends on the chain-length of the polymeride. The Plotnikov effect is not a special type of Rayleigh-Mie scattering. A. J. E. W.

Scattering of light by pigment particles. D. H. Clewell (*J. Opt. Soc. Amer.*, 1941, 31, 521—527).—An empirical scattering function correlating scattering with particle size is derived. Diffraction scattering accounts for the observed max. scattering of visible light by particles of size $\sim\lambda/2$. Long $\lambda\lambda$ may be scattered more effectively than short $\lambda\lambda$ by particles of 0.3—0.5 μ . L. J. J.

Angular distribution of light scattered in liquids. L. H. Dawson and E. O. Hulburt (*J. Opt. Soc. Amer.*, 1941, 31, 554—558).—Data are recorded for the intensities of polarised components of the light from a W lamp scattered by Et₂O, CCl₄, CS₂, C₆H₆ and H₂O, at angles 22.5—157.5°. The results are consistent with scattering by centres small compared with the λ , together with an additional scattering depending on the liquid. L. J. J.

Kerr effect and molecular order in highly compressed gas and liquids. E. Kuss and H. A. Stuart (*Physikal. Z.*, 1941,

42, 95—105).—Methods for the study of relations between the gaseous and liquid states are discussed, with special reference to the partly ordered arrangement of mols. in liquids. Kerr const. (*B*) data are given for N₂, CO₂, and CH₄ at 25°, and CO₂ and C₂H₄ at 40°, with $p = 36$ —420 atm. In CO₂ the p -dependence of *B* is similar above and below θ_c . The *B* vals. for CO₂ and C₂H₄ show considerable deviations from the Langevin-Born theory with $\rho > \rho_c$; a p -dependence of *B* in CH₄ and A (data not given) is also contrary to this theory. The results are used to examine the variation of rotation hindrance and internal field anisotropy in the fluids (cf. Peterlin and Stuart, A., 1940, I, 11). A. J. E. W.

Thermodynamic properties of a mixture of gas and radiation. N. R. Sen (*Indian J. Physics*, 1941, 15, 219—227).—Mathematical. Emden's theorem on expansion and contraction of a polytropic gas mass with conservation of polytropic index is extended to the case of a variable polytrope, which under similar conditions, has the distribution of polytropic index unchanged. An interrelation of the polytropic indices *N* and *n* for (*P*, ρ) and (*p*, ρ) relations is derived, *P* and *p* being the total and gas pressures. Hence, a method is given for estimating the temp. distribution in a variable polytrope when its max. and min. polytropic indices are known. W. J.

Statistical mechanics of nearest neighbour systems. E. W. Montroll (*J. Chem. Physics*, 1941, 9, 706—721).—Mathematical. For solids in which the intermol. forces are so short-ranged that practically all the potential energy of the system results from interaction between nearest neighbouring mols., the evaluation of the partition function is reduced to the solution of linear homogeneous operator equations. The theory is applied to a superficial treatment of two-dimensional ferromagnetic plates. J. W. S.

Simplest liquid crystalline substances. Chemical morphology of liquids. C. Weygand and R. Gabler (*Z. physikal. Chem.*, 1940, B, 46, 270—275).—The simplest types of liquid cryst. compounds are the *p*-*n*-alkylbenzoic acids. The possible structure of the double mols. of the alkoxybenzoic acids (cf. Bennett *et al.*, A., 1939, II, 214) is discussed. The existence of an 8-ring with H as a member is not accepted, but the compounds are assumed to be similar in structure to the homologous diphenylpyridazines with a 6-ring. The cryst. solid and cryst. liquid fixed points for the *p*-*n*-alkoxybenzoic acids are given. A. J. M.

Determination of electric moments by the molecular beam method. H. Scheffers (*Physikal. Z.*, 1940, 41, 89—97).—With an improved method of calculation the results of Estermann and Fraser (A., 1934, 15) lead to a val. for the dipole moment (μ) of HCl (0.91 D.) which is in satisfactory accord with ϵ data. Certain conditions are recommended for accurate μ measurements by the mol. beam method; the electric field strength (*X*) should be sufficient to reduce the intensity at the centre of the beam by ~25%. With mols. possessing a resolved μ val. along the axis of thermal rotation some of the mols. in the beam are undeflected, while the remainder are deflected symmetrically to either side; the deflexion is $\propto X$. This "linear" effect, which is \gg the normal effect (deflexion $\propto X^2$), is investigated theoretically, and expressions are derived for the calculation of μ from appropriate measurements. A. J. E. W.

Linear electric field effect in the molecular beam experiment with ammonia. H. Scheffers (*Physikal. Z.*, 1940, 41, 98—105).—An apparatus for the study of mol. beams of NH₃ is described. The results obtained confirm the occurrence of the "linear" deflexion (cf. preceding abstract), but the derived μ val. (~0.56 D.) is \ll that obtained by the ϵ method. Reasons for the discrepancy are discussed. A. J. E. W.

Effect of temperature on the surface tension of liquids. J. Frenkel (*J. Physics U.S.S.R.*, 1940, 3, 355—358).—Theoretical. The effect of temp. on surface tension is determined by considering the thermal motion of the surface as a superposition of capillary waves, as in Debye's theory of solid bodies. The theoretical result is in satisfactory agreement with the equations of Eötvös and Ramsay and Shields, but can be applied strictly only to simple monat. liquids, such as fused metals. The effect of adsorbed films on the surface tension is also considered. A. J. M.

New relation between the surface tension and the coefficient of compressibility of liquids. C. Sălceanu (*Z. physikal. Chem.*,

1940, **A**, 187, 170—174).—Assuming that surface tension (γ) \propto the no. of mols. per unit length, the equation $\gamma = K(Nd/M)^{\frac{1}{2}}$. $\beta^{-\frac{1}{2}}$ can be derived (β = coeff. of compressibility, K = const., and d , M , and N have their usual meaning). For most of 23 liquids the val. of K lies between 130 and 150×10^{-13} , but low vals. for AcOH, MeOH, EtOH, and PrOH suggest that there is an increase in the no. of mols. per unit length on account of dissociation. C. R. H.

III.—CRYSTAL STRUCTURE.

Refraction patterns of the surfaces of opaque and translucent solids. R. S. Rivlin and W. A. Wooster (*Nature*, 1941, **148**, 372).—Several coatings of Diakon are painted on the rough surface of the solid to form a cast, which is then peeled off and examined in the manner described previously (A., 1941, I, 132). L. S. T.

X-Ray criterion for distinguishing between lattice curvature and fragmentation. E. Orowan and K. J. Pascoe (*Nature*, 1941, **148**, 467—468).—Rotation photographs of moderately extended Cd crystals show that X-ray methods can often decide whether local curvature of the lattice or disintegration into a mosaic of fragments is present. These photographs often contain very sharp spots; two corresponding spots on the same side of the equator are equally sharp, but the two corresponding spots reflected by the other side of the plane are smeared to form arcs. The dissymmetry of corresponding spots is explained by assuming that the lattice plane is curved. L. S. T.

Structures of thallium. H. Lipson and A. R. Stokes (*Nature*, 1941, **148**, 437).—Debye-Scherrer photographs of Tl (99.995%) at room temp. give a_0 3.4496 \pm 2 A. and c_0 5.5137 \pm 4 A. Above 230°, Tl is body-centred cubic, a_0 3.874 \pm 1 A., and not face-centred cubic (cf. A., 1931, 288). L. S. T.

X-Ray diffraction examination of material having the composition SiO. H. N. Baumann, jun. (*Trans. Electrochem. Soc.*, 1941, **80**, Preprint 9, 75—77).—X-Ray studies on materials of the approx. composition SiO, produced by the reduction of SiO₂ or silicates, indicate that they are mixtures of SiO₂ and Si. J. W. S.

X-Ray diffraction pattern of tricalcium aluminate. L. J. Brady and W. P. Davey (*J. Chem. Physics*, 1941, **9**, 663—666).—The diffraction pattern of very pure 3CaO,Al₂O₃ has been determined with a new form of X-ray diffraction apparatus, in which the pattern is measured with a Geiger-Müller counter and recorded automatically in an intensity-angle graph. The unit cube has an edge of 15.235 A. and contains 264 atoms. J. W. S.

X-Ray and crystallographic studies of plant virus preparations.—See A., 1941, III, 1077.

Magnetic susceptibility of titanium and zirconium. C. F. Squire and A. R. Kaufmann (*J. Chem. Physics*, 1941, **9**, 673—677).—The paramagnetic susceptibilities of Ti and Zr increase linearly with rising temp. from 20° k. to the temp. at which a crystal structure change occurs. The variations of the electrical conductivity, sp. heat, and linear expansion with temp. indicate that this structural change involves a change in electron configuration. J. W. S.

Magnetic and X-ray studies on titanium and zirconium with dissolved hydrogen. J. Filtzwilliam, A. Kaufmann, and C. Squire (*J. Chem. Physics*, 1941, **9**, 678—682).—H dissolved in Ti and Zr changes the crystal lattice of the metals from hexagonal close-packed to almost a face-centred cubic lattice. At room temp. the paramagnetic susceptibilities of Ti and Zr are increased and decreased, respectively, by dissolved H. The Fe (0.11%) present in the Zr used was pptd. out and regained its ferromagnetic property when H was dissolved in the Zr, kept for 1 hr. at 1000°, but redissolved again when the H was removed by heating at 900° in a vac. J. W. S.

Effect of temperature on initial susceptibility and coercive force of ferromagnetic crystals. M. V. Dechtjar and N. I. Andriuschin (*J. Physics U.S.S.R.*, 1940, **3**, 487—492).—The initial susceptibility χ in fields up to 0.18 oersted of deformed and tempered crystals of meteorite Fe (8% Ni, 0.5% Co) has been measured at temp. from 15° to 300° and 700°, respectively. In deformed crystals χ decreases with temp. in both the [110] and the [100] directions. In crystals tempered

in H₂ at 500°, χ in the [100] direction increases with temp. up to 400° and falls to a min. val. at 600°, above which it again increases. In the [110] direction the dependence on temp. is similar, but the min., in this case at 500°, is more pronounced and the rise, above 500°, is steeper. The coercive force of tempered crystals decreases with temp. up to 300° in both the [100] and the [110] directions; above 300° it increases to a max., at 600° and 500°, respectively, and decreases rapidly at higher temp. O. D. S.

Amorphous state. XVIII. Electrical conductivity of substances in the amorphous and crystalline states. P. P. Kobeko, E. W. Kuvshinski, and N. I. Schischkin (*J. Physics U.S.S.R.*, 1940, **3**, 287—296).—The variation of sp. resistance (ρ) with temp. (T) of borax, Rochelle salt, and LiOAc has been determined for the substances in the amorphous and cryst. states. For the melts of these substances the portion of the function $\log \rho = f(1/T)$ is not linear. For substances in the vitreous state, i.e., considerably supercooled liquid, the relation is linear at low temp. The coeff. B in the expression $\log \rho = A + B/T$ is almost the same for the above substances in the cryst. and vitreous states. The connexion between these results and X-ray structure is considered, and it is shown that Zachariassen's view (A., 1933, 12, 1107), that the arrangement of mols. in the lattices of silicate and borate glasses is the same as in the cryst. state, may be extended to all supercooled systems irrespective of their composition. Since B does not alter, any considerable change of the structure of a liquid with temp. is not possible. A. J. M.

Quantum theory of magnetostriction of ferromagnetic single crystals. S. V. Vonsovski (*J. Physics U.S.S.R.*, 1940, **3**, 181—190).—The temp.-dependence of the magnetostriction const. of cubic Fe and Ni crystals is calc. on the basis of Bloch's quantum-mechanical model. Experimental data for Ni are in agreement with the theory when only spin-coupling interaction is taken into account, but in the case of Fe the spin-orbital coupling must be included. A generalised theory for binary ferromagnetic alloys is presented. L. J. J.

Artificial stress formation [in crystals]. A. W. Stepanov (*J. Physics U.S.S.R.*, 1940, **3**, 421—426).—If a scratch is made on the surface of a rock-salt crystal this acts as the origin of a stress. Breaking takes place at the scratch when the crystal is under external stress. It is the micro-defects of the surface and the plastic rotation of the lattice which play the leading part in the formation of such artificial stresses. A. J. H.

Twinning of Chile saltpetre under plastic strain. R. I. Garber (*J. Physics U.S.S.R.*, 1940, **3**, 179—180).—NaNO₃ crystals can be twinned by applying a shearing stress tangential to the twinning (110) plane. Concentrated loading produces an "elastic twinning" effect similar to that found with calcite (A., 1939, I, 285), but "arrested" twins are readily produced at room temp. The twin-crystal boundary appears to be several thousand at. layers thick. L. J. J.

Allotropes of tellurium by X-ray diffraction. H. Bose and B. B. Ray (*Indian J. Physics*, 1941, **15**, 233—240).—Pptd. Te is not amorphous but is the hexagonal variety in a finely-divided state, i.e., it is the same as metallic Te. The diffraction patterns were taken at different temp. and results disprove the existence of two dynamic allotropes. Molten Te, on chilling, yields a fine powder which is not amorphous. The supposed increase in sp. heat on exposure to X-rays owing to a change in crystal structure is not supported. The X-ray pattern of liquid Te is given and discussed. W. R. A.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES.

Anisotropy of electrical resistance of sodium in a magnetic field. Isotropy of the electron gas in alkali metals. E. Justi and J. Kramer (*Physikal. Z.*, 1940, **41**, 105—106).—The resistance of a Na crystal at 20.4° k., in a magnetic field of 33,200 G. perpendicular to the direction of current flow, is ~ 9 —22% > the normal val., the increment passing through two diametrically opposed max. as the field is rotated through 360°. The anisotropy, which is also observed with K, is not detected at 78° k. It is deduced that the conductivity electrons in alkali metals are free, but that the electron gas

is not isotropic owing to the effect of "elastic anisotropy" (cf. Justi and Kohler, A., 1940, I, 103). A. J. E. W.

Galvanomagnetic experiments on the electrical conduction process in indium. A. Foroud, E. Justi, and J. Kramer (*Physikal. Z.*, 1940, **41**, 113—121).—Sp. resistance (ρ) data for In rods at 4.22—373° K., with transverse and longitudinal magnetic fields (H_{\perp} , H_{\parallel}) ≥ 40 kg., are recorded. With $H = 0$ and $T < \sim \frac{1}{2}\Theta$ ($\Theta =$ characteristic temp.), ρ follows a T^3 law. The relative increase in ρ ($\Delta\rho_{\parallel}/\rho_0$) due to a field is $\propto (H_{\perp}/r)^n$ ($r = \rho_T/\rho_0$), where n is ~ 2 at low H_{\perp}/r vals. but falls rapidly with $H_{\perp}/r > \sim 1000$ kg. The effect of H_{\parallel} is approx. half that of H_{\perp} . Kohler's rule (cf. A., 1938, I, 128) is verified over wide ranges of H , T , and residual resistance. $\log(\Delta\rho_{\parallel}/\rho_0) - \log(H_{\perp}/r)$ curves ("reduced Kohler diagrams") eliminate temp. effects and enable the ρ - H relations in metals to be compared directly; such curves for Al and In differ only by a const. factor, and confirm the "type" theory of metallic conduction. A. J. E. W.

Electrical resistance of polycrystalline gold, lead, niobium, and tantalum in strong transverse magnetic fields at low temperatures. E. Justi (*Physikal. Z.*, 1940, **41**, 486—498; cf. preceding abstract).— ρ data are recorded for Au, Pb, Ta, and Nb at 4.22—78° K., with $H_{\perp} \geq 40$ kg. With Au $\Delta\rho_{\parallel}/\rho_0$ approaches a saturation val. at high H_{\perp}/r owing to high elastic anisotropy, but $\Delta\rho_{\parallel}/\rho_0$ for Pb increases rapidly with H_{\perp}/r without evidence of saturation. The effect of H_{\perp} is very small with Ta and unmeasurable with Nb, an anomaly which is explained by reference to the crystal structure of Bi. The "type" theory of metallic conduction is correlated with the periodic table by reduced Kohler diagrams for a no. of metals. A. J. E. W.

Dielectric properties of glass cloth in compressed gases. B. M. Vul, G. M. Kovalenko, and J. M. Parnas (*J. Physics U.S.S.R.*, 1940, **3**, 321—326).—The breakdown voltage of glass cloth increases with increase of gas pressure (N_2 up to pressures of 16 kg. per sq. cm. and 50-cycle a.c. were used), but is $<$ that of the pure gas gap of the same thickness. The breakdown voltage is unaffected by irradiating the glass cloth with radiations from Ra. The dielectric loss was also determined. $\tan \delta$ is independent of voltage and pressure and is ~ 0.001 . The resistivity of glass cloth is $\sim 10^{15} \Omega$ -cm. A. J. M.

Electrical resistance and thermo-electric power of the transition metals. H. H. Potter (*Proc. Physical Soc.*, 1941, **53**, 695—705).—Measurements and their variations with temp. are tabulated and plotted for V, Ta, Nb, Ti, Zr, Rh, Ir, Cr, and Mo. Results are discussed in relation to the Mott-Jones theory; they cannot be described by the simple theory using d bands of simple shape. N. M. B.

Displacement caused by tension in the critical values of superconductivity for tantalum. N. E. Alexeevski (*J. Physics U.S.S.R.*, 1940, **3**, 443—446).—The variation of resistance with magnetic field in the neighbourhood of the transition to superconductivity has been measured for a Ta wire under tension up to 16 — 18×10^3 kg. per sq. cm., at temp. from 3.90° to 4.22° K. The crit. field increases linearly with tension, the effect being greatest at the highest temp. The crit. current also increases linearly with tension. The crit. field varies linearly with temp. at const. tension. The max. increase in crit. temp. is 0.125° K. for a tension 18×10^3 kg. per sq. cm. O. D. S.

Gyromagnetic effect in superconductors. I. K. Kikoin and S. V. Gubar (*J. Physics U.S.S.R.*, 1940, **3**, 333—354; cf. A., 1938, I, 442).—The Einstein-de Haas effect has been investigated for superconducting Pb, and is shown to be a general effect for all superconductors. Diamagnetic bodies could also have gyromagnetic properties. The numerical val. of the Landé factor obtained is 1 ± 0.03 , indicating that the magnetisation of a superconductor is not conditioned by electron spin, but by closed electron circuits. A. J. M.

Statistical computation of magnetic susceptibility. F. Kaner (*J. Physics U.S.S.R.*, 1940, **3**, 153—164).—A statistical method, based on Kirkwood's calculation of the partition function of a binary alloy, is developed and applied to the study of ferromagnetic substances and paramagnetic salts. The method accounts for the existence of two Curie points and an additional sp. heat above the Curie point, and indicates that magnetic susceptibility at low temp. is $<$ that given by

Heisenberg's formula, and tends to zero as the temp. tends to zero, in the case of paramagnetic substances. L. J. J.

Magnetic measurements on semiquinone radicals in solution. L. Michaelis (*J. Amer. Chem. Soc.*, 1941, **63**, 2446—2451).—A differential magnetometric method is described and used to confirm production of semiquinone radicals (causing greater susceptibility) by partial reduction of dyes. The dye may be reduced rapidly (thiazine, e.g., by ascorbic acid, or slowly (oxonine, e.g., by glucose. The max. concns. of free radicals thus discerned agree with these previously disclosed by potentiometric measurements. Dimerisation does not occur. R. S. C.

Magnetisation of matter by ultra-violet radiation. C. M. Focken (*Nature*, 1941, **148**, 438).—The results obtained by Ehrenhaft *et al* (A., 1941, I, 158) could not be confirmed. L. S. T.

Optical measurement of ultrasonic absorption in liquids. A. Lindberg (*Physikal. Z.*, 1940, **41**, 457—467).—A modification of Grobe's method for measurement of ultrasonic absorption coeffs. (a) (cf. A., 1938, I, 303), suitable for practical application, is described. The method is accurate to $\sim 5\%$, but cannot be used with $a > \sim 50$ cm.⁻¹ a data are given for C_6H_6 and MeOH at 20°, with frequencies of 15—43 and 30—90 MHz. respectively; temp. coeffs. (10—25°) are also given for MeOH. A. J. E. W.

Ultrasonic dispersion and fracture velocity. A. Smekal (*Physikal. Z.*, 1940, **41**, 475—480).—Structural imperfections in homogeneous solids may give rise to regions of ultrasonic dispersion; owing to the high dispersion frequency ($\sim 5 \times 10^8$ cm.⁻¹ in crystals to $\sim 10^{11}$ cm.⁻¹ in inorg. glasses) these regions cannot be detected directly, but they are closely related to fracture propagation phenomena. The velocity of fracture is $<$ the normal velocity of elastic waves, and depends on the structure of the solid. Certain fracture effects (including Wallner's "fracture lines") are explained by the theory, which is fully confirmed by the results of Schardin *et al*. A. J. E. W.

Velocity of sound in liquids and chemical constitution. M. R. Rao (*J. Chem. Physics*, 1941, **9**, 682—685).—In any homologous series the const. R of the law $v^2 M/d = R$, where v is the velocity of sound and M the mol. wt. of the liquid (cf. A., 1940, I, 434), follows the law $R = aM + \beta$ where a is a general const. (~ 14) and β is a const. characteristic of the series. R is an additive function of the chemical structure and contributions attributable to C, H, O, Cl, and Br and the double linking are evaluated. J. W. S.

Specific heat of superconductive tantalum. K. Mendelssohn (*Nature*, 1941, **148**, 370).—A correction (cf. A., 1941, I, 457). L. S. T.

Heat capacities of molecular lattices. I. Introduction. II. Structure of metallic lithium. R. C. Lord, jun. (*J. Chem. Physics*, 1941, **9**, 693—699, 700—705).—I. Theoretical. The interpretation of the heat capacities of mol. crystals is discussed. The assumption that the lattice part of the mol. heat capacity can be represented by a single Debye function with the appropriate no. of degrees of freedom is expected to be valid except at temp. low relative to the characteristic temp. θ of the Debye function. The conversion of C_p into C_v for mol. lattices is discussed.

II. The failure of the heat capacity of Li to accord with the Debye equation for at. lattices is attributed to association into diat. mols. Assuming the vibration frequency of Li_2 to be 350 cm.⁻¹, as deduced from the band spectrum, the calc. heat capacity is in accord with the Debye equation. The implications of the theory in respect of the metallic properties of Li are discussed. J. W. S.

Thermal expansion of lead from 0° to 320°. A. R. Stokes and A. J. C. Wilson (*Proc. Physical Soc.*, 1941, **53**, 658—662).—Measurements by the high-temp. X-ray camera (cf. A., 1941, I, 200) for the variation with temp. of the lattice parameter of Pb are reported. The coeff. of expansion is deduced and equations for the results are found. N. M. B.

Heat transfer in helium II. P. G. Strelkov (*J. Physics U.S.S.R.*, 1940, **3**, 176—178).—The apparent thermal conductivity of liquid He II was estimated from the size of the cylindrical bubble around an electrically heated wire immersed in the liquid. The vals. obtained differed markedly according as the wire was free or pressed between two plates. L. J. J.

Thermal conductivities of tungsten and molybdenum at incandescent temperatures. R. H. Osborn (*J. Opt. Soc. Amer.*, 1941, **31**, 428—432).—Thermal conductivities (κ) of W and Mo filaments have been measured at 1100—2000° K. by an optical pyrometer method in which surface temp. of the filaments were determined at points in the neighbourhood of cooling junctions. κ for W varies linearly from 1.170 w. per (cm.² °K. per cm.) at 1100° K. to 1.026 w. per (cm.² °K. per cm.) at 2000° K., and κ for Mo varies linearly from 1.083 w. per (cm.² °K. per cm.) at 1200° K. to 0.666 w. per (cm.² °K. per cm.) at 1900° K. L. J. J.

Model experiments in flow channels with different [fluid] media. W. Bardili (*Physikal. Z.*, 1940, **41**, 63—76).—The principle of similitude is used to determine the relative streaming velocities (u) required for attainment of given Mach and Reynolds nos. (β , R) in air, H₂, He, NH₃, CO₂, C₂H₂, iso-C₄H₁₀, Et₂O, Hg, H₂O, and glycerol. The energy losses (N) corresponding with given β , R , and u vals. are also determined; high R and low N vals. are obtained when $\eta \times$ (kinematic viscosity)² is small, while high d and compressibility and low η favour low N for a given β val. The relative channel lengths giving equal N for given R and β vals. are also calc., and the possibility of simultaneous attainment of equal R and β vals. in model experiments is discussed. A. J. E. W.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

Diffusion and thermal diffusion of hydrogen-deuterium, with ϵ note on the thermal diffusion of hydrogen-helium. H. R. Heath, T. L. Ibbs, and N. E. Wild (*Proc. Roy. Soc.*, 1941, **A**, **178**, 380—389).—The diffusion coeff., measured for H₂-D₂, is in agreement with theory. From measurement of the thermal separation of mixtures of the gases the repulsive force index is deduced; it is < the val. obtained from viscosity data. The force const. is determined from these observations and so the complete law of force operating in collisions between unlike mols. is obtained. Measurements of the thermal separation in H₂-He mixtures were made and the force index was determined. This pair of mols. is "harder" than H₂-D₂ (cf. following abstract). G. D. P.

Thermal diffusion in hydrogen-deuterium mixtures. K. E. Grew (*Proc. Roy. Soc.*, 1941, **A**, **178**, 390—399).—The thermal separation of H₂-D₂ mixtures in the temp. range -183° to 425° was measured. The thermal diffusion ratio so obtained gives a val. of the force index for the H₂ and D₂ fields in agreement with the val. obtained from viscosity data. This result, due to a revised method of calculation, removes a discrepancy noted by other workers (cf. preceding abstract). G. D. P.

Maximum boiling mixtures of chloroparaffins with donor liquids. R. H. Ewell and L. M. Welch (*J. Amer. Chem. Soc.*, 1941, **63**, 2475—2478).—35 new max. boiling mixtures of the type exemplified by the system CHCl₃-COMe₂ have been reported. Not only haloforms exhibit this behaviour but also chlorinated paraffins with 2 Cl in the α -position, or with one α -Cl and one or more β -Cl. Many esters, ketones, aldehydes, ethers, and *tert.* amines act as donor liquids in the formation of H bonds with the active H of the chlorinated paraffin. W. R. A.

Pressure-volume-temperature relations in solutions. VI. Apparent and partial volumes of sodium bromide dissolved in glycol and the energy-volume coefficients of the solutions at various pressures and temperatures. R. E. Gibson and O. H. Loeffler (*J. Amer. Chem. Soc.*, 1941, **63**, 2287—2295).—Sp. vols. at 25°, thermal expansions, and compressions of a series of solutions of NaBr in (CH₂-OH)₂ have been measured. A table of vols. covering the pressures 1—1000 bars, the temp. 25—105°, and the concn. 0—25% NaBr has been compiled. First and second derivatives have been obtained and hence thermal expansibilities, compressibilities, P - T and E - V coeffs., and ($C_p - C_v$) vals. for the solutions and apparent and partial vols., compressibilities, and thermal expansibilities of NaBr in solution have been derived. The E - V coeffs. are approx. independent of concn. in the range of P and T studied. The apparent vols. of NaBr are independent of temp. at const. vol. of the solution. Thermal expansibilities of (CH₂-OH)₂ in the pure state and in solution at different

pressures and temp. can be represented as a linear function of $1/(B + P)$. W. R. A.

Theory of solutions. III. Vapour pressure curves of selected binary systems in relation to volume changes on mixing and heats of mixing. K. Fredenhagen and E. Tramtitz (*Z. physikal. Chem.*, 1940, **B**, **46**, 313—378; cf. A., 1939, **I**, 516).—Exchange of thermal energy between mols. A and B in a two-component system cannot cause lowering of the v.p. of either, which can only arise from processes involving a decrease in the free energy of A and B . Such processes are mutual dilution (i), chemical reactions (ii), and changes in intermol. forces (iii). Case (i) arises when the vol. ($V_{A,B}$) and energy ($U_{A,B}$) of the components are additive; in this case Raoult's law and the distribution law hold over the whole range of mol. fractions (C₂H₄Cl₂-C₆H₆). For the case of unimol. reaction between A and B , the v.p. vals. are correlated with the dissociation const. (K) in the intermol. compound [case (ii); COMe₂-CHCl₃, Et₂O-CHCl₃, H₂O-HF], and with ΔV and ΔU vals., over the whole range of mol. fractions. The systems H₂O-NH₃, H₂O-HCN, and EtOH-cyclohexane represent combinations of cases (ii) and (iii). L. J. J.

Measurement of tension in solutions. A. F. Scott and G. M. Pound (*J. Chem. Physics*, 1941, **9**, 726—727).—Using an apparatus similar to that of Vincent (A., 1941, **I**, 179) the val. of the max. tension (t) prior to breaking has been determined for H₂O and aq. Ca(NO₃)₂. t decreases with increasing [Ca(NO₃)₂], suggesting that the solute weakens the attraction between solvent mols. t varies almost linearly with the apparent mol. vol. of Ca(NO₃)₂, and by extrapolation it is deduced that the tension would become zero when the apparent mol. vol. is 66 c.c., approx. the mol. vol. of anhyd. Ca(NO₃)₂. J. W. S.

Viscosity of suspensions and solutions. E. W. J. Mardles (*Nature*, 1941, **148**, 345).—Solutions of colloids and crystalloids show the same viscosity behaviour as that described previously (A., 1940, **I**, 439) for suspensions. If the explanation given for suspensions is valid, then solvated ions are asymmetric, and during the flow of salt solutions and colloidal dispersions the particles become oriented. Curves for NaCl, AlCl₃, K oleate, tannic acid, kaolin, and mica dispersed in H₂O-EtOH show that the ratio η/η_0 increases with increase of η_0 . L. S. T.

"Internal friction Wien effect" in electrolyte solutions. A. Deubner (*Physikal. Z.*, 1940, **41**, 110—111).—Calculation shows that a pressure difference of ~200 atm. between the ends of a capillary tube of length 1 cm. and diameter 0.01 mm. containing 0.0001M-Ca₂Fe(CN)₆ should reduce the η of the solution to that of pure H₂O. A. J. E. W.

Rate of diffusion of sulphonamide compounds. F. Hawking (*Quart. J. Pharm.*, 1941, **14**, 226—233).—After 24 hr. contact with agar containing Ehrlich's reagent at 35° the travel in cm. of a saturated solution is sulphanilamide 4.2, sulphapyridine 2.6, sulphathiazole 2.7, sulphadiazine 2.0, and sulphanilylguanidine 3.1. After 24 hr. contact with 15% gelatin at 15° the corresponding concn. 1 cm. away from the interface is 3.1, 1.5, 2.2, 0.45, 2.6 mg. per 100 c.c., respectively. The diffusion coeff. for these compounds in 15% gelatin at 15° is ~0.157 (cm., days). H. G. R.

Rate of formation of nuclei in supersaturated solutions as a means of determining the constitution of the solutions. I. Potassium chlorate solutions. II. Solutions of paraffin-chain salts. J. Stauff (*Z. physikal. Chem.*, 1940, **A**, **187**, 107—118, 119—129).—I. An arrangement, consisting essentially of two differentially connected photo-electric cells, is described, whereby the appearance of each new nucleus in a solution is registered by a discontinuity in the photo-electric current. The rate of formation of nuclei in KClO₃ solutions was studied in relation to the degree of supersaturation and to the concn. The results are in agreement with modern theory, although, owing to lack of knowledge of some of the consts., an exact calculation of the mol. concn. is not yet possible.

II. The relation between rate of nucleus formation and concn. has been studied in solutions of Na laurate, palmitate, and tetradecyl sulphate. The results are consistent with theory where knowledge of the constitution of the solutions permits comparison. The existence of two kinds of micelle in paraffin-chain salt solutions is confirmed. F. L. U.

Solid solution. I. Elastic sphere model as applied to solid solutions and deviations from Vegard's rule. B. J. Pines (*J. Physics U.S.S.R.*, 1940, 3, 309—319).—The distortion of the lattice by one dissolved atom is calc. using the elastic sphere model. The "elastic" distortion energy of the lattice and the change in linear dimensions of a disordered solid solution are calc. The latter is compared with experimental data on deviations from Vegard's rule that the lattice parameter of a solid solution varies linearly with concn. The calculation gives the correct sign and order of magnitude for the deviation except for the alloys of transition elements and of Ag and Au. The calc. vals. are, however, usually < those observed, and this discrepancy is considerable in the case of Fe-V and Fe-Cr alloys. In the case of Fe-V alloys this may be connected with the change of compressibility consequent on the building up of the 3*d* shell. A. J. M.

Determination of constitution diagrams with X-rays. C. S. Barrett (*J. Appl. Physics*, 1941, 12, 385—394).—The fundamental principles of the determination of phase diagrams for alloys are reviewed. The advantages and disadvantages of the X-ray and other methods of investigation of phase equilibria are discussed. The location of phase boundaries by measurement of lattice parameters is described, and the difficulties associated with the method are considered. The investigation of ternary alloys is described and the method of minimising the work necessary in obtaining points on the diagram is given. A. J. M.

Photo-electric alloys of alkali metals. A. Sommer (*Nature*, 1941, 148, 468).—The alloys of Cs and Rb with Bi and Sb most sensitive to light are those that correspond with the formula XY_3 , where Y is the alkali metal. $SbCs_3$ has the highest photo-electric quantum yield; at the optimum λ of 4600 Å., one electron is emitted for 5 incident light quanta. The sp. resistance of the Sb-Cs alloys rises sharply with an increase in the ratio Cs : Sb. The alloys of the $SbCs_3$ type can be regarded as semi-conductors, and they represent borderline cases between metallic alloys and ionic crystals. Alloys with a ratio Cs : Sb > 3 : 1 have not been obtained. L. S. T.

Dilatometric study of the order-disorder transformation in copper-gold alloys. F. C. Nix and D. MacNair (*Physical Rev.*, 1941, [ii], 60, 320—329).—Graphs of true coeffs. of thermal expansion plotted against temp. for previously well-ordered alloys containing 22, 25, and 30 at.-% of Au show a slow rise from -190° to $\sim 50^\circ$, followed by a flat plateau to $\sim 250^\circ$, then a rapid rise to a peak at the crit. ordering temp. θ_c , and finally a fall to a second flat plateau extending to $\sim 450^\circ$ above θ_c . The portion below the plateau can be represented by a Grueneisen equation if additivity is assumed for the consts. taken from the equation for pure Cu and Au. The plateau above θ_c disagrees with the Bethe-Peierls theory of the vanishing of short-range order. Curves for specimens previously quenched from above θ_c show min. similar to those in the comparable sp. heat curves of Sykes (cf. A., 1937, I, 74). N. M. B.

Transformation in eutectoid copper-aluminium alloys. V. Crystal structure of the martensite γ' phase. G. Kurdjumov, V. Mirezki, and T. Stelletzkaja (*J. Physics U.S.S.R.*, 1940, 3, 297—308).—X-Ray patterns of the γ' phase of the Cu-Al system (Al 13.5%) indicate that the Cu and Al atoms are arranged at the points of a hexagonal close-packed lattice with a 2.06 Å., c/a 1.62. The γ' lattice is formed as the result of a martensite transformation of the ordered β phase solid solution, and it is possible by using this fact to calculate the dimensions of the superlattice of the γ' phase. By quenching a β phase single crystal it was transformed into the γ' phase, and pole figures were obtained for the main planes of the γ' lattice relative to the axes of the β crystal. The (0001) plane of the γ' lattice is parallel to (110) of the β phase, and the [110] direction of the former is parallel to [111] of the latter. The positions of the Al and Cu atoms in the γ' lattice are calc. using the rearrangement of a body-centred lattice into a hexagonal close-packed one, with the result that it is possible to choose a simpler cell for the γ' phase, belonging to the rhombic system, with 8 atoms in the unit cell. This is advisable because the arrangement of identical atoms in the calc. lattice lacks hexagonal symmetry. The dimensions of the rhombic cell are a 4.51, b 5.20, c 4.22 Å., space-group V_{13}^2 . A. J. M.

Beta region of the gold-cadmium alloy system. E. A. Owen and W. H. Rees (*J. Inst. Met.*, 1941, 67, 141—151).—Quenched alloys with 38—62 at.-% of Cd have been examined by X-ray methods and the results have been combined with those previously obtained with alloys containing < 36 at.-% of Cd in an equilibrium diagram. A rhombohedral phase α_2 extends from 46 to 48.5 at.-% of Cd at 200° and from 41 to 47.5 at.-% of Cd at 600° , and a cubic body-centred phase β from 50.2 to 54.5 at.-% of Cd at 300° ; there is a fairly wide field of $\alpha_2 + \alpha_3$ and a narrower field of $\gamma_2 + \beta$, the former becoming more restricted and the latter broader with rise in temp. The β phase has an ordered structure and in quenched alloys rapidly decomposes at room temp. to a more complex structure. A. R. P.

Alpha solid solutions of the zinc-silver system. II. Lattice parameters with notes on the ζ phase. H. Lipson, N. J. Petch, and D. Stockdale (*J. Inst. Met.*, 1941, 67, 79—85).—Precision measurements of the Ag lattice gave $a = 4.0775$ Å. after correction. Vals. of a for 20 Zn-Ag alloys with up to 35 at.-% of Zn are tabulated and the observed d compared with those calc. from a ; only with the alloys with 3, 17, and 29 at.-% of Zn were the two vals. in complete agreement, the calc. vals. for other alloys being < the observed, indicating the presence of up to 20 vacant sites per 10,000 unit cells. The val. of a is related to the at.-% of Zn present (C) by $a = 4.0775 - 1.82 \times 10^{-3}C - 1.81 \times 10^{-6}C^2$. X-Ray examination of powders of alloys with 37—41 at.-% of Zn after prolonged annealing at 300° gave results not in accordance with the accepted equilibrium diagram. A. R. P.

Constitution of alloys of aluminium with magnesium and silicon. H. W. L. Phillips (*J. Inst. Met.*, 1941, 67, 257—273).—Al, Si, and Mg_2Si form a ternary eutectic at 551° , Si 12.97, Mg 4.97%, and Al, Mg_2Si , and Mg_2Al_3 a ternary eutectic at 450° , the composition of which could not be determined. The surface of separation of the Al- Mg_2Si binary complex is ridge-shaped with a flat max. at 595° ; the ridge coincides with the Al- Mg_2Si quasibinary line only where it intersects the binary valley and lies on the Mg side of this line in Al-rich alloys. Free Si does not disappear at this line but requires an excess of Mg for its suppression; in alloys with excess of Si the Al-rich phase contains little Mg and changes only slightly in composition during freezing, but with excess of Mg Al takes increasing quantities into solid solution as freezing proceeds. With slow cooling free Si appears in binary Si-Al alloys at Si 0.2%, and Mg_2Al_3 in binary Mg-Al alloys at Mg 4.25%. In the ternary system addition of 0.1% of Si to Mg-Al alloys or of 0.1% of Mg to Si-Al alloys causes separation of Mg_2Si , the solubility of which in Al is therefore $\sim 0.2\%$. A. R. P.

Constitution of alloys of aluminium with magnesium and iron. H. W. L. Phillips (*J. Inst. Met.*, 1941, 67, 275—287).—Al, FeAl₃, and Mg_2Al_3 form a ternary eutectic at 451° , Mg 33, Al 67% with very little Fe. The binary Al- Mg_2Al_3 eutectic valley slopes towards the Al-Mg axis with increasing % Mg and with 20—30% of Mg the primary FeAl₃ field is entered with only 0.25% of Fe. Under the conditions studied Al dissolves < 0.01% of Fe and $\sim 4\%$ of Mg; Fe slightly reduces the solubility of Mg but Mg has little effect on that of Fe. The ternary alloys are very subject to undercooling and segregation, FeAl₃ being easily undercooled and Mg_2Al_3 making its appearance at Mg contents well below equilibrium solubility. Parts of the ternary diagram and several sectional diagrams are given. A. R. P.

X-Ray investigation of aluminium-cobalt-iron system. O. S. Edwards (*J. Inst. Met.*, 1941, 67, 67—77).—The system has been examined up to 50 at.-% of Al; there is a small α (face-centred cubic) field around the Co corner, an extensive β (body-centred cubic) field extending from the Fe corner, and between them a medium-sized ($\alpha + \beta$) field which broadens out towards the Co-Al side of the ternary diagram. In alloys quenched from 800° there appears to exist a face-centred cubic α' phase containing 4 atoms per unit cell; this may be the metastable compound Co_2Al which normally decomposes at $> 800^\circ$ but appears to be more stable in the presence of Fe. A. R. P.

X-Ray study of the iron-copper-nickel equilibrium diagram at various temperatures. A. J. Bradley, W. F. Cox, and H. J. Goldschmidt (*J. Inst. Met.*, 1941, 67, 189—201).—From X-ray powder photographs of slowly cooled and quenched

Fe-Cu-Ni alloys equilibrium diagrams have been constructed for 20°, 750°, 850°, 950°, and 1050°; the diagram for 20° confirms the work of Köster and Dannöhl (A., 1936, 152). The α -($\alpha + \alpha'$) phase boundary rapidly approaches the Cu-Fe side with rise in temp. and the sharp inflexions at the Cu end of the boundary line almost disappear at 950°.

A. R. P.

Effect of temperature and pressure on the solubility of chlorine monoxide in water. C. H. Secoy and G. H. Cady (*J. Amer. Chem. Soc.*, 1941, **63**, 2504—2508).—The aq. solubility of gaseous Cl_2O has been measured at five temp. between 3.5° and 20° over a range of pressures and the equilibrium const. (K) for the reaction $2\text{HOCl}_{\text{aq.}} = \text{Cl}_2\text{O} + \text{H}_2\text{O}_{\text{liq.}}$ has been evaluated for each temp. Plotting K against $1/T$ indicates that the heat of dissolution of Cl_2O increases rapidly with temp. from 9300 g.-cal. at 5° to 16,000 g.-cal. at 18°. Several approx. vals. of thermodynamic consts. have been derived.

W. R. A.

Miscibility gap in the system acetone-carbon disulphide. K. Clusius and W. Ringer (*Z. physikal. Chem.*, 1940, **A**, 187, 186—194).—Investigation of the heat of mixing of COMe_2 and CS_2 has shown that at temp. $< -50^\circ$ there is a region of immiscibility. The miscibility curve is unsymmetrical, the greater portion of the gap being on the CS_2 -rich side. The upper crit. temp. and composition are 51.3_8° and 66.2 mol.-% of CS_2 , respectively.

C. R. H.

Solubility relationships of salts. F. J. Garrick (*Phil. Mag.*, 1941, [viii], **32**, 353—364).—In a series of salts in which the solubility (s) differences are not too small the order of increasing s is that of increasing vals. of $S = W - U$, where W and U are the electrostatic hydration and lattice energies, respectively. W is expressed as a function of the valencies (z_+, z_-) and "corr." radii ($r'_+ = r_+ + 0.25$, $r'_- = r_- - 0.25 \text{ \AA}$) of the ions, and it is found that: (a) increase of z_+ and z_- in the same ratio increases s ; (b) decrease of r'_+ and r'_- in the same ratio decreases s ; (c) for salts of symmetrical valency type s is min. when $r'_+ = r'_-$; (d) for salts of valency type 1:2 s is min. when $r'_{\text{biv.}} = \sim 1.2 r'_{\text{univ.}}$. Data for alkali and alkaline-earth halides, perchlorates, and sulphates confirm the theory for inert-gas type ions and polyat. ions with approx. spherical symmetry, but other ions show abnormalities.

A. J. E. W.

Distribution of di- and tri-methylamines between chloroform and water at 25°. W. A. Felsing and E. Ball (*J. Amer. Chem. Soc.*, 1941, **63**, 2525; cf. A., 1933, 898).—The true distribution coeff. is $2.75 + 0.109c_2$ for NHMe_2 and $0.45 + 0.021c_2$ for NMe_3 ($c_2 =$ amine concn. in CHCl_3 layer), at aq. concns. up to 4M. and 3M., respectively.

W. R. A.

Simple derivation of Langmuir's adsorption isotherm. H. Dunken (*Z. physikal. Chem.*, 1940, **A**, 187, 105—106).—The expression is derived by equating the rates of adsorption and desorption at equilibrium, as for a reaction of the type $A + B \rightleftharpoons AB$.

F. L. U.

Adsorption in photographic development. I. Non-adsorption of organic developers to metallic silver. E. S. Perry, A. Ballard, and S. E. Sheppard (*J. Amer. Chem. Soc.*, 1941, **63**, 2357—2361).—The determination by ultrafiltration of the adsorption of 0.01N-quinol (I) and 0.01N-*p*- $\text{NHMe}_2\text{-C}_6\text{H}_4\text{-OH}$ in an atm. of H_2 to colloidal Ag in aq. gelatin containing a borate-nitrate buffer, $p_{\text{H}} \sim 9$, is described. In contrast with other data (cf. A., 1934, 1079) 99.56% of (I) and 99.77% of (II) were recovered. The bearing of the observed results on the theory of photographic development is discussed. Preliminary experiments with Ag_2S did not show any adsorption of (I) or (II).

W. R. A.

Molecular surface energy of hydrocarbon oils.—See B., 1941, I, 529.

Thickness of the rigid water film at a quartz-water interface from a measurement of Newton's rings. W. G. Eversole and P. H. Lahr (*J. Chem. Physics*, 1941, **9**, 686—689).—From measurements of the radii of successive Newton's rings obtained with a quartz lens and disc before and after the evaporation of a H_2O layer, the thickness of the H_2O film on each surface is found to be $\sim 100 \text{ \AA}$.

J. W. S.

Friction between a liquid surface and a solid not wetted by it. D. S. Subrahmanyam (*Indian J. Physics*, 1941, **15**, 191—208).—If the narrow, uniform stem of an oscillating float is coated with paraffin wax, the oscillations are damped more quickly than when it is clean, and the val. of the logarithmic decrement

increases as the amplitude decreases. On the assumption that this effect is due to friction between the solid and the liquid, analysis of the oscillations gives ~ 15 dynes as the limiting kinetic frictional force per cm. of the line of contact. The val. of this friction decreases at low velocities and when the H_2O surface is contaminated.

W. R. A.

Teaching theory of ideally dilute solutions. C. Wagner (*Z. physikal. Chem.*, 1940, **B**, 46, 379—386).—A purely thermodynamical method of deriving Raoult's law and van 't Hoff's expression for the osmotic pressure of dil. solutions from Henry's distribution law, suitable for instructional purposes, is described.

L. J. J.

Equilibrium in aerosols. II. Aerosol of ammonium chloride. I. D. Gurevitch and N. A. Filimonov (*Kolloid. Shurn.*, 1941, **7**, 53—58; cf. A., 1941, I, 39).—The particles in aerosols produced by mixing damp air with NH_3 and HCl, or with NH_4Cl and HCl, contain amounts of H_2O that would be in equilibrium with the given NH_4Cl -HCl mixture and the H_2O v.p. in the air. The liquid phase of aerosols is in equilibrium with the vapour phase, and no special theory of the particle structure is necessary.

J. J. B.

Preparation of hydrosols by freezing. T. J. Shea, W. E. Dooley, and C. Schwob (*J. Amer. Chem. Soc.*, 1941, **63**, 2531—2532).—The prep. of electrolyte-free charcoal hydrosol by the alternate freezing and melting of a paste of wet charcoal and final mixing with a large vol. of H_2O is described.

W. R. A.

Solvation in disperse systems. XIII. Stabilisation of zinc oxide suspensions in media of various polarities. V. Margaritov (*Kolloid. Shurn.*, 1941, **7**, 47—52).—The rate of sedimentation of ZnO in C_6H_6 decreases when the concn. of ZnO increases from 2 to 20%. Small additions of stearic acid (I) (up to 0.25%) lower the rate below 6% of ZnO; at higher [ZnO] the apparent rate of sedimentation is that of contraction of the sediment; this contraction is favoured by (I) since it destroys the structure of the sediment. The apparent radius of ZnO particles in C_6H_{14} , C_6H_6 , and PhNO_2 is strongly reduced by (I), that in *iso*- $\text{C}_3\text{H}_7\text{-OH}$ is slightly reduced, and that in NH_2Ph raised by (I). Paraffin wax, which does not stabilise ZnO in C_6H_6 , intensifies the stabilising effect of (I). These phenomena are explained by orientation of polar mols. at the ZnO surface.

J. J. B.

Swelling of clay. II. A. S. Korshuev and Z. L. Borisova (*Kolloid. Shurn.*, 1941, **7**, 59—65; cf. A., 1941, I, 43).—The swelling of various clays is measured. The increase of vol. has a max. in 0.0001—0.00001N-NaCl, 0.1N- Na_2SO_4 , or 0.1N- Na_2CO_3 . Ca salts reduce the swelling.

J. J. B.

Thixotropy of laminar films of aluminium and zinc hydroxides. N. G. Koltashev (*Kolloid. Shurn.*, 1941, **7**, 23—33).—Films of $\text{Al}(\text{OH})_3$ and $\text{Zn}(\text{OH})_2$, produced by passing NH_3 over saturated solutions of $\text{KAl}(\text{SO}_4)_2$ or ZnSO_4 , were dried at 75° until their solid content was 10%, mixed with H_2O , and the time of their thixotropic gelation was determined. It was, e.g., 1 min. for a 2.5% suspension of $\text{Zn}(\text{OH})_2$ or a 2.3% suspension of $\text{Al}(\text{OH})_3$. When the films were separated by sedimentation into fractions of various particle size, the concn. c' at which the gelation time was 1 min. was higher for coarse than for finely dispersed fractions. By displacing H_2O with other liquids thixotropic suspensions in C_6H_6 , PhMe , EtOH , and CHCl_3 were prepared; for these c' was inversely \propto the mol. surface energy of the solvent.

J. J. B.

Colloid and semi-colloid solutions of highly polymeric substances and their hydrolysis products. A. M. Almazov (*Kolloid. Shurn.*, 1941, **7**, 67—88).—The viscosity η of aq. solutions of sol. starch (I), amylopectin (II), erythro-dextrin (III), achroodextrin (IV), and glucose (V) increases with concn. first linearly, and at higher concn. more rapidly. The η of starch solutions increases rapidly with concn. The mol. wt. calc. by the equation of Biltz is for starch 165,500, for two (I) 13,500 and 9000, for (II) 12,350, for (III) 4000, and for (IV) 2900. 0.1N-KCl reduces the η of 5% solutions of (I) by 2—8%, of (II) by 7%, of (III) by 1.65%, of (IV) by 1.14%, and of (V) by 1.00%. The electrical conductivity κ of commercial dextrin has a max. at 30 g. per 100 c.c., and κ of other dextrans increases with concn. at low concns. rapidly and at high concns. slowly. κ of 0.1N-KCl is lowered by dextrans etc.; 5 g. per 100 c.c. cause a lowering by 8—10%; (V) is more active than (II). The lowering of κ of KCl in

isoviscous solutions is the larger, the smaller is the mol. wt. of the non-electrolyte. The lowering by commercial dextrin has a max. at 0.03—0.05N-KCl. The κ of LiCl and NaCl is lowered by dextrin to the same extent as that of KCl. The rule $\kappa\eta = \text{const.}$ is not valid in presence of colloids; colloid solutions have a structure which affects κ and η in different ways. J. J. B.

Electrical properties of solids. IX. Dependence of dispersion on mol. wt. in the system polyvinyl chloride-diphenyl. X. System polyvinyl chloride-tetrahydronaphthalene. R. M. Fuoss (*J. Amer. Chem. Soc.*, 1941, **63**, 2401—2409, 2410—2413; cf. A., 1941, I, 202).—IX. The fractionation of polyvinyl chloride (I) by dissolution in mesityl oxide and COMe₂ and pptn. by MeOH is described and vals. of the intrinsic η of the fractions in COMe₂C₆H₁₁ are determined. Dielectric consts. and loss factors at from 60 to 10,000 cycles per sec. are given for (i) different fractions of (I) plasticised with 20% of Ph₂ at 45°, 55°, and 75°, and (ii) unfractionated polymerides of different average mol. wt., a range of five to one in mol. wt. being covered. Results agree with the assumptions that (a) the dipole moment per monomeride unit (μ) in a linear polymeride of the type $(-\text{CH}_2\text{CHX}-)_n$ is independent of the degree of polymerisation and (b) the most probable relaxation time as measured by the frequency of max. absorption at a given temp. \propto the degree of polymerisation.

X. Dielectric consts. and loss factors, at from 60 to 10,000 cycles, of (I) plasticised with 8 to 40% of tetrahydronaphthalene (II) over the temp. range 5—80° have been determined. μ per (CH₂:CHCl) with increasing concn. of (II) approaches 1.73 D., the theoretical limiting val. for a linear polymeride of alternating structure assuming free rotation, and becomes independent of temp. with increasing temp. Positive deviations in μ vals. at high concns. of (I) or low temp. are explained qualitatively as an increase of average moment due to configurations in which the chain mols. are not in their most probable state. W. R. A.

p_H changes in solutions of polyacrylic acid irradiated with X-rays. L. Holzapfel (*Naturwiss.*, 1940, **28**, 254—255).—The p_H changes of solutions of polyacrylic acid of various concns. when irradiated with X-rays are reversible, i.e., the p_H returns to its original val. after some time. The variation of p_H with duration of irradiation was also investigated. There is a rhythmic variation of p_H with time analogous to periodic pptn. by X-rays and ultra-violet light. No change in p_H was observed when solutions of polymethylacrylamide were irradiated with X-rays. A. J. M.

Properties of alginic acid. II. Ammonium alginate as protective colloid. J. K. Novodranov and E. K. Smirnova (*Kolloid. Shurn.*, 1941, **7**, 89—94).—NH₄ alginate reduces the rate of sedimentation of Ca arsenate (I). Stable suspensions are obtained, e.g., by mixing 1 g. of (I) with 2.5 g. of Na alginate, 7 c.c. of N-HCl, and 17 c.c. of N-aq. NH₃, or 50 g. of (I) with Na alginate 3.4 g., N-HCl 17.5 c.c., and N-aq. NH₃ 27.5 c.c. J. J. B.

Mechanism of gelation of lyophilic colloids (gelatin). I. I. Sokolov (*Kolloid. Shurn.*, 1941, **7**, 39—46).—An attempt was made to determine the structure of gelatin sols and gels by pptn. with EtOH. X-Ray examination of the ppts. obtained revealed "cryst." spacings (11.3 and 2.8 Å.) in a 10% gel, weak spacings in a 10% or 5% sol, and none in a 1% sol. Gelation involves a more perfect orientation of gelatin chains; a lattice structure is more stable than the random distribution of chains. J. J. B.

Structural properties of coagulates. Volume of silver iodide coagulates. B. G. Zaprometov and E. I. Smoligina (*Kolloid. Shurn.*, 1941, **7**, 13—22).—The rate of sedimentation of 0.87% AgI sol prepared in presence of an excess of KI is almost const. when the sol is coagulated by KNO₃ or K₂SO₄; it increases during coagulation when Cu(NO₃)₂ or CuSO₄ is used. The sedimentation vol. regularly decreases in the course of coagulation by K salts, Al salts, and 0.02—0.1N-Cu salt solutions; in presence of 0.01N-CuSO₄ or -Cu(NO₃)₂ it first increases since the coagulation of sol particles is faster than the aggregation of the sediment, and then remains const. or slowly decreases. J. J. B.

Factors influencing flocculation and precipitation. Theory and variables. E. M. Beavers, J. E. Magoffin, and F. K. Cameron (*Text. Res.*, 1940, **11**, 23—29).—The close relation-

ship between the phenomena associated with the flocculation and pptn. of a colloidal dispersion is indicated. Existing work relevant to both processes is discussed, and the variables which influence them are indicated. J. G.

Plant virus preparations.—See A., 1941, III, 1077.

Dialysis potential.—See B., 1941, I, 511.

VI.—KINETIC THEORY. THERMODYNAMICS.

Chemical equilibria of thermal associations. A. Wassermann (*Proc. Roy. Soc.*, 1941, **A**, 178, 370—379).—Five gaseous thermal reactions of the type $a + b = c$ are discussed. The equilibrium const. K of an association can be expressed in two ways by formulae of the type $K = W \exp(-\Delta E/RT)$; the factors W and ΔE in this relation are computed and the contributions of the internal vibrations of the reactants deduced. G. D. P.

Structure, properties, and mode of formation of inorganic compounds of high mol. wt. of the type of the heteropoly-acids (phosphotungstic and metatungstic acids). G. Jander (*Z. physikal. Chem.*, 1940, **A**, 187, 149—160).—A general review of the structure and properties of heteropoly-acids is given. Data are recorded for the dialysis coeffs. in presence of 1.0N- and 2.0N-NaNO₃ of Na₆[HW₆O₂₁,aq.] (I) and Na₆[H₂O₄(W₃O₉)₄,aq.] (II) at various acidities and after ageing. With increasing p_H and dilution the (II) ion is transformed into two (I) ions according to the scheme $[\text{H}_2\text{O}_4(\text{W}_3\text{O}_9)_4, \text{aq.}]^{6-} + 8\text{H}_2\text{O} \rightleftharpoons [(\text{OH})_2(\text{W}_3\text{O}_9)_4, \text{aq.}]^{4-} + 6\text{H}_2\text{O} \rightleftharpoons 2[\text{H}_2\text{W}_6\text{O}_{21}, \text{aq.}]^{6-} + 6\text{H}_2\text{O} \rightleftharpoons 4\text{H}^+ + 2[\text{HW}_6\text{O}_{21}, \text{aq.}]^{5-} + 6\text{H}_2\text{O}$. As the p_H is further increased $[\text{HW}_6\text{O}_{21}, \text{aq.}]^{5-}$ splits up into H⁺ and (WO₄,aq.)⁻ which is stable in alkaline solutions. The time for equilibrium to be established depends on [WO₄] and on the method of preparing the solution. Although H⁺ are liberated during hydrolysis, the p_H of (II) solutions is increased on keeping because H₆[H₂O₄(W₃O₉)₄,aq.] is a stronger acid than H₅[HW₆O₂₁,aq.]. C. R. H.

Interaction of aldoses with α -amino-acids or peptides. III. Determination of equilibrium constants. A. Katchalsky. **IV. Percentage combination. V. Continuous back-titration of the system to its initial p_H .** M. Frankel and A. Katchalsky (*Biochem. J.*, 1941, **35**, 1024—1027, 1028—1033, 1034—1038; cf. A., 1939, II, 10).—III. Assuming that the reaction between the aldose and the NH₂-acid is bimol. and occurs with the undissociated aldose and the NH₂-acid anion, equilibrium consts. for glucose with glycine, alanine, leucine, and several simple peptides are calc. from potentiometric measurements between p_H 7 and 9. The val. of the equilibrium const. is determined mainly by the nature of the terminal NH₂-acid group of the peptide bearing the free NH₂.

IV. The extent of the combination between glucose and the NH₂-acids and peptides can be calc. from the p_H depression caused by the addition of the sugar. Vals. thus obtained are verified by determination of the free NH₂ (Van Slyke). At equilibrium the extent of reaction increases to a max. with increasing p_H .

V. The amount of alkali required to keep an aq. mixture of glucose and glycine at its original p_H is not a direct measure of the amount of the reaction product. There is a max. in the plot of total alkali added at equilibrium against initial p_H , but whereas the max. for glycine is at p_H 9, that for glycyglycine is at 7.5—8. This difference is explained by the difference in the acid dissociation consts. of the two substances and by the difference in the equilibrium consts. of their reaction with glucose. A. L.

Association of camphor with phenol and cresols. A. W. Francis (*J. Amer. Pharm. Assoc.*, 1941, **30**, 229—240).—The f.p. curves, d , partial solubilities in H₂O, partial v.p., temp. effects on mixing liquid solutions, and cryoscopic mol. wt. determinations were investigated. Equimol. mixtures of camphor (I) and phenol (II), and (I) and *o*-cresol, have m.p. —12° and —18°, respectively. There appear to be \leq two complexes in mixtures of (I) and (II) or *o*-, *m*-, or *p*-cresol, the two complexes with 1 and 2 mols. of (II) or cresol per mol. of (I) predominating. The 1:1 complex predominates with (I)—(II) and the 1:2 complex with (I)—cresol. All the complexes are readily dissociated. An equimol. mixture of (I) and cresol contains 6—9% of free cresol, whilst in a 20% mixture with (I), there is 1.5% of free *m*-cresol. F. O. H.

Electrolytic dissociation of citric acid in sodium chloride solutions. B. Adell (*Z. physikal. Chem.*, 1940, **A**, 187, 66—78).—The classical dissociation consts, K' , K'' , and K''' of citric acid were determined at 18° by measuring potentiometrically the $[H^+]$ vals. in buffer solutions of known ionic strength containing NaCl. The results are combined with those of Bjerrum and Unmack for the corresponding thermodynamic consts. K_a to give the activity coeffs. of the several species. K_e/K_a vals. for the isomeric univalent anions are calc. F. L. U.

Electrolytic dissociation in nitric acid as studied by Raman effect. N. R. Rao (*Indian J. Physics*, 1941, **15**, 185—189).—The intensities of the 1050 cm^{-1} lines, due to NO_3^- ions, from equimol. solutions of $NaNO_3$ and HNO_3 (2.3—14.85M.) have been compared. $NaNO_3$ is assumed to be completely dissociated at all concns. At low concns. of HNO_3 the increase of dissociation with dilution is small and \ll in concn. solution. This is attributed to an increase in H^+ ions at low concns. favouring the reaction $H^+ + NO_3^- \rightarrow HNO_3$. W. R. A.

Phase equilibria in the two-component system, ethylene-propylene, in the critical temperature region. W. G. Schneider and O. Maass (*Canad. J. Res.*, 1941, **19**, B, 231—240).—For a 1:1 $C_2H_4-C_3H_6$ mixture d_c is 0.230 g. per c.c. and θ_c is $58.30 \pm 0.05^\circ$. For mass-vol. ratios $>$ or $<$ 0.230, at const. vol., the temp. of liquid disappearance was respectively $<$ or $>$ 58.3° . Without stirring the attainment of equilibrium is slow and uncertain. Compositions and densities of the vapour and liquid phases become uniform at the crit. temp. (cf. A., 1934, 246); vigorous stirring probably favours mutual dispersion of liquid and vapour near the crit. temp., so that discontinuity in d is not detectable. The postulation of liquid equimol. groups persisting at the crit. temp. and becoming mutually dispersed with vapour mols. is preferred to that of continuity of state. A. A. E.

System trimethyl phosphate-water. H. A. Pagel and F. S. Maxey (*J. Amer. Chem. Soc.*, 1941, **63**, 2499—2500).—The composition at the eutectic temp. (-77.0°) is Me_3PO_4 52% from f.p. data. W. R. A.

Distillation "constants." D. F. Kelly, D. MacCarthaigh, and J. Reilly (*Nature*, 1941, **148**, 438—439).—The equation of Rosanoff *et al.* (A., 1914, ii, 800) has been combined with the concept of relative volatility, α (Walker *et al.*, "Principles of Chemical Engineering," New York, 1937), to give the equation $K = \log a/(P_1 - P_2)$, where K is the const. in Rosanoff's equation, and P_1 and P_2 are the v.p. of the pure components. The equation of Rosanoff *et al.* relating E_0 and x_0 , the initial wt. and initial mol. fraction of a component in a binary mixture, respectively, with E and x , the quantities remaining in the mixture after a finite partial distillation, is re-written in the form $\log (E/E_0) = [\alpha/(\alpha - 1)] [\log (x_0/x) + \log \{(1 - x)/(1 - x_0)\}]$. L. S. T.

System $2CaO \cdot SiO_2 - K_2O \cdot CaO \cdot SiO_2$, and other phase-equilibrium studies involving potash. W. C. Taylor (*J. Res. Nat. Bur. Stand.*, 1941, **27**, 311—323).—A study of the system $2CaO \cdot SiO_2 - K_2O \cdot CaO \cdot SiO_2$ indicates the probable existence of an intermediate compound $K_2O \cdot 23CaO \cdot 12SiO_2$ (I). The optical properties and the interplanar spacings of the X-ray diffraction pattern of (I) have been determined. (I) exists in a region of the $K_2O-CaO-Al_2O_3-SiO_2-Fe_2O_3$ system in which Portland cement compositions fall. Studies on $3CaO \cdot SiO_2 - K_2O \cdot Al_2O_3$ and $2CaO \cdot SiO_2 - K_2O \cdot Al_2O_3$ mixtures show that $K_2O \cdot Al_2O_3$ does not exist in that region of the $K_2O-CaO-Al_2O_3-SiO_2$ system which is directly concerned with Portland cement. Evidence for the formation of (I) in commercial Portland cement clinker is offered, although it has not been identified microscopically, possibly on account of minor acid constituents, *e.g.*, SO_3 , combining with most of the K_2O present. C. R. H.

Heat of formation of oleums from sulphur trioxide and water.—See B., 1941, I, 540.

[Heat of] formation of semiacetals. K. L. Wolf and K. Merkel (*Z. physikal. Chem.*, 1940, **A**, 187, 61—65).—With the use of the calorimeter previously described (A., 1937, I, 330) the heat of formation of a semiacetal from Pr^oOH and $EtCHO$ has been determined; the total effect comprises a negative heat of mixing and a positive heat of chemical reaction. The vals. are: $\Delta U_{293} = 1.30$ kg.-cal. per mol. of aldehyde for mixing, and -8.2 ± 0.1 kg.-cal. per mol. for the reaction. The reaction rate was also followed by thermal measure-

ments, with results that agree with those obtained earlier by optical means. F. L. U.

Heats of isomerisation of the five hexanes. E. J. R. Prosen and F. D. Rossini (*J. Res. Nat. Bur. Stand.*, 1941, **27**, 289—310).—The heats of isomerisation of $n-C_6H_{14}$, γ - and β -methyl-pentane, $\beta\gamma$ - and $\beta\beta$ -dimethylbutane in the liquid state at 298° k. and in the gaseous state at 0°, 298°, 600°, and 1000° k. have been calc. from data for the heats of combustion in the liquid state. At 0° k. the order of increasing stability is that given. C. R. H.

Vapour pressure studies. II. Chlorobenzene- α -nitropropane. J. R. Lacher, W. B. Buck, and W. H. Parry (*J. Amer. Chem. Soc.*, 1941, **63**, 2422—2425).—Excess free energy of mixing for $PhCl$ and $PrNO_2$ has been measured at 75° and 120°. The heats of mixing of the pairs $PhCl-PrNO_2$, $(CH_2Br)_2-PrNO_2$, and $PhCl-(CH_2Br)_2$ have been measured. The excess entropy of mixing varies approx. linearly with the vol. change for a considerable variety of liquid mixtures. W. R. A.

VII.—ELECTROCHEMISTRY.

Effect of the chemical durability of glass on the asymmetry potential and reversibility of the glass electrode. E. H. Hamilton and D. Hubbard (*J. Res. Nat. Bur. Stand.*, 1941, **27**, 27—32).—The departures from the linear relationship between the voltage and p_H occurring when a glass electrode is in contact with solutions of $p_H < 9$ are \propto the extent of attack on the glass as measured interferometrically. Such departures are increased after the electrode has been immersed in concn. alkali solution. The inner surface of a glass bulb adsorbs dye (Victoria-blue B) to a much greater extent than the outer surface, so it is suggested that the difference in the adsorptive capacities of the surfaces for ions may be the cause of the glass electrode asymmetry potential. J. W. S.

Decomposition potentials of cobalt, nickel, and copper from chloride and bromide solutions.—See B., 1941, I, 556.

Polarographic wave heights in mixtures of benzylideneacetone and acetophenone. S. Wazzonek and H. A. Laitinen (*J. Amer. Chem. Soc.*, 1941, **63**, 2341—2343).—The polarographic determination of $COPhMe$ (I) in the presence of $CHPh \cdot CH \cdot COMe$ (II) in 50% Pr^oOH containing (i) 0.2N- $NMe_4 \cdot OH$ at 25°, (ii) 0.1N- NH_4Cl at 25°, (iii) 0.1N- $LiCl$ at 25°, and (iv) 0.001M- $NMe_4 \cdot OH$ and 0.1N- NMe_4Br at 28°, has been investigated. (II) has no effect on the total diffusion current of (I) but affects the shape of the wave of (I). In (i) (cf. A., 1938, II, 282) and (iv) (I) yields two waves which are attributed to the direct reduction of (I) to $(CPhMe \cdot OH)_2$ and $CHPhMe \cdot OH$, whilst in (ii) and (iii) only one wave is observed. Possible influences of (II) on (I) are briefly discussed. W. R. A.

VIII.—REACTIONS.

Law governing the genesis and development of chemical reactions. N. S. Akulov (*J. Physics U.S.S.R.*, 1940, **3**, 165—174).—A universal relation between the time required for the spontaneous initiation of a reaction in isothermal conditions, the induction period, and the progress of the ensuing reaction with time, is developed. L. J. J.

After-burning of carbon monoxide: spectroscopic evidence for abnormal dissociation. A. G. Gaydon (*Nature*, 1941, **148**, 284).—A correction (cf. A., 1941, I, 472). L. S. T.

Speed of oxidation of nitric oxide in mixtures of oxygen and nitrogen.—See B., 1941, I, 540.

Effect of negative groups on reactivity. M. G. Evans and M. Polanyi (*Nature*, 1941, **148**, 436—437).—The acceleration caused by the presence of negative groups (X_1, X_2, \dots) in reactions of the type $Na + XRX_1 = NaX + RX_1$ is discussed in terms of resonance. The accelerating influence of a negative substituent on the reactivity of a mol. parallels the contribution of the substituent to the electron affinity of the latter. L. S. T.

Isotopic exchange between carbon tetrabromide and bromine. J. M. Hodges and A. S. Miceli (*J. Chem. Physics*, 1941, **9**, 725).—The rate of exchange of radioactive Br between Br_2 and CBr_4 has been measured for the gas phase at 170—200° and for the liquid phase at 107—160°. The reaction appears

to be homogeneous and its velocity $\propto [\text{CBr}_4] \times [\text{Br}_2]^{0.5}$. This indicates an exchange between CBr_4 mols. and Br atoms, and the energy of activation of this reaction is zero in the gas and ~ 3 kg.-cal. per g.-mol. in the liquid. No parallelism between the intensity of the radioactivity of the Br_2 and the sp. reaction rate is detectable and no reaction occurs at room temp., indicating that the reaction is thermal and not initiated by the energy of nuclear decomp. The theoretical rates of reaction between CBr_4 and Br on the basis of the collision theory are 10^4 — 10^5 times the observed rates. J. W. S.

Rates of ammonolysis of α -halogeno-acids and α -halogeno-acylpeptides. A. F. Chadwick and E. Pacsu (*J. Amer. Chem. Soc.*, 1941, **63**, 2427—2431).—Interaction of $\text{CHRHalCO}_2\text{H}$ or α -halogenoacylpeptides with an excess of aq. NH_3 is bimol., the first-order reaction const. being \propto the partial pressure of NH_3 in equilibrium with the solution. Heats and entropies of activation are calc. Yields of NH_2 -product are improved by rational application of the results. R. S. C.

[Catalytic] production of benzoic acid, maleic acid, and benzaldehyde from toluene at atmospheric pressure.—See B., 1941, II, 410.

Catalyst for Kjeldahl combustion of coals.—See B., 1941, I, 524.

Precipitation of basic lead acetate. Effect of small amounts of bismuth as inhibitor.—See B., 1941, I, 541.

Iron [electro]deposition.—See B., 1941, I, 553.

Electrolytic reduction of organic compounds at alloy cathodes. II. Reduction of methyl *n*-propyl ketone to pentane at cadmium-bismuth cathodes. H. J. Read (*Trans. Electrochem. Soc.*, 1941, **80**, Preprint 8, 69—73; cf. A., 1936, 687).—The reduction of COMePr^α to $n\text{-C}_5\text{H}_{12}$ has been studied at Cd-Bi cathodes containing 0—100% of Cd. Pure Bi and pure Cd give yields of 11.8% and 72.3%, respectively, whilst alloys containing 10—98% of Cd give yields of 40—55%. The relative constancy of the yield over a wide range of [Cd] is attributable to the two-phase structure of the alloys. J. W. S.

Photosynthesis of brown cells in the interaction of chlorophyll and carotenoids. C. Montfort (*Z. physikal. Chem.*, 1940, **A**, 186, 57—93).—Photochemical problems arising from modern views of assimilation are discussed. The importance of the part played by the yellow colouring matter of plants in the assimilation process is emphasised. An analysis of the colouring matter present in yellowish-brown diatoms and in brown algae has been carried out by the chromatographic method in order to discover the fraction of the total energy absorbed by the yellow colouring matter. The extent of photosynthesis in plants of which the plastids contain only chlorophyll *a* and carotenoids has been examined for red and blue light of the same energy. It is shown that brown cells, in marked contrast to green cells, use blue light much more extensively than was formerly supposed. The deviations from the quantum law for blue light in the case of pure chlorophyll absorption are so great that it is necessary to assume a co-operative absorption by chlorophyll and carotenoids. Certain carotenoids, especially fucoxanthin, which absorbs in the green and greenish-blue, are to be regarded as assimilation pigments. A. J. M.

Action of light on wool and related fibres.—See B., 1941, II, 421.

IX.—METHODS OF PREPARATION.

Separation of a mixture of ^{84}Kr and ^{86}Kr from normal krypton in a separation tube. K. Clusius and G. Dickel (*Naturwiss.*, 1940, **28**, 711).—Two methods are available for the separation of a complex mixture of isotopes. A binary mixture can be prepared from the original mixture, from which the individuals can be isolated, or the middle components are enriched by removal of the lighter and heavier ones. The first of these methods has been carried out with Kr using a separation tube 27 m. long. A mixture of ^{84}Kr 22% and ^{86}Kr 78% was obtained. The composition of the mixture was determined both by the mass spectrograph and by weighing. A. J. M.

Behaviour of calcium sulphate at high temperatures. E. S. Newman (*J. Res. Nat. Bur. Stand.*, 1941, **27**, 191—196).—Thermal analysis, microscopic, and X-ray methods indicate that the $\beta \rightarrow \alpha$ transition of CaSO_4 occurs at $\sim 1214^\circ$ and

the conclusion that the α form is unstable is confirmed. A eutectic mixture of $\alpha\text{-CaSO}_4$ and CaO with m.p. $\sim 1365^\circ$ appears to exist. The existence of basic Ca sulphates could not be confirmed. J. W. S.

Production of concentrated carbon isotope 13 by thermal diffusion. A. O. Nier and J. Bardeen (*J. Chem. Physics*, 1941, **9**, 690—692).—A thermal diffusion column 74 ft. long and divided into three sections, with the hot walls at 367 — 385° and the cold walls at $\sim 27^\circ$, permits removal of 0.308 g. of CH_4 every 48 hr. in which the ^{13}C : ^{12}C ratio is increased 11.5 times. Expenditure of 156 kw.-hr. of energy results in transport of 0.0135 g. of ^{13}C per 24 hr. The output is in good agreement with the theoretical val. J. W. S.

Exchange reaction between gaseous and combined nitrogen. T. H. Norris, S. Ruben, and M. D. Kamen (*J. Chem. Physics*, 1941, **9**, 726).—Contrary to the observations of Nishina and others (A., 1941, I, 420), after purification by repeated passing overheated CuO $< 0.01\%$ of radioactive $^{15}\text{N}_2$ exchanges with NO_2' or NO_3' when the gas (50 c.c.) is shaken with 0.1N- or N- NaNO_2 or NaNO_3 (10 c.c.) during 10 min. J. W. S.

New copper salts in therapeutics.—See A., 1941, III, 1054.

X.—ANALYSIS.

Gravimetric determination of bromide in organic material.—See A., 1942, III, 76.

Determination of small amounts of tellurium in copper.—See B., 1941, I, 554.

Colour analysis and colorimetry. I. Determination of nitrate. G. V. L. N. Murty (*Proc. Indian Acad. Sci.*, 1941, **A**, 14, 43—47).—Colours developed in the colorimetric determination of NO_3' by $\text{OH}\cdot\text{C}_6\text{H}_4\cdot\text{SO}_3\text{H}$ (I) and $\alpha\text{-OH}\cdot\text{C}_{10}\text{H}_7\cdot\text{SO}_3\text{H}$ (II) have been analysed by the Keuffel and Esser colour analyser. (I) and (II) are efficient in different but sp. concn. ranges. W. R. A.

Determination of phosphorus and sulphur in coke.—See B., 1941, I, 525.

Determination of zinc in magnesium alloys.—See B., 1941, I, 557.

Quantitative spectrochemical method for zinc die-casting analysis.—See B., 1941, I, 555.

Determination of lead in biological material. Polarographic method.—See A., 1941, III, 1087.

Analysis of dental amalgams containing mercury, silver, gold, tin, copper, and zinc.—See B., 1941, I, 556.

Ferric thiocyanate reaction. C. A. Peters, and C. L. French (*Ind. Eng. Chem. [Anal.]*, 1941, **13**, 604—607; cf. A., 1939, I, 578).—Optimum conditions for the development of the red colour have been determined. The optimum acidity is 0.01N.; other concns. decrease the colour intensity. With HCl, an increase in [CNS'] offsets the bleaching effect of high [HCl], and at high [CNS'] less acid is needed to develop the same colour intensity. The increase in colour with an increase in [CNS'] is linear with no indication of a max. A variation in $[\text{Fe}^{+++}]$, over a limited range, does not change the amount of acid necessary for max. colour intensity. The min. amounts of anions which reduce the intensity of colour are in the order $\text{P}_2\text{O}_7^{4-}$, HPO_4^{2-} , PO_4^{3-} , H_2PO_4^- , SO_4^{2-} , Cl^- , and NO_3^- ; salt interference commences when the molar $[\text{NaCl}]$ is 260,000 times that of the $[\text{Fe}^{+++}]$, and that of $\text{P}_2\text{O}_7^{4-}$ is 0.84 times that of the $[\text{Fe}^{+++}]$. With NO_3' , the colour is increased. Extraction of the red colour by Et_2O depends on the ratio $\text{CNS}' : \text{Fe}^{+++}$, which must be high. The initial concns. of reagents required to produce a colour lasting < 15 min. are 0.0000179M- FeCl_3 (0.1 p.p.m. Fe^{+++}), 0.2N- NaCNS , 0.01N-HCl, and 0.0064N- H_2O_2 . L. S. T.

Colorimetric determination of iron with kojic acid. M. L. Moss with M. G. Mellon (*Ind. Eng. Chem. [Anal.]*, 1941, **13**, 612—614).—Spectrophotometric investigation indicates that kojic acid (I) is a suitable compound for the colorimetric determination of Fe^{+++} . The orange colour obtained is relatively stable and conforms to Beer's law over a wide range. p_{H} can vary between 5.5 and 7. Max. sensitivity occurs with an $[\text{Fe}^{+++}]$ between 1 and 20 p.p.m. for a cell thickness of 1 cm. The colour is less intense than that formed with CNS' or *o*-phenanthroline, thus permitting

determinations to be made on samples higher in Fe without dilution. Curves showing the effect of reagent concn., [Fe⁺⁺⁺], p_{H_2} , and diverse ions are reproduced. Al⁺⁺⁺, P₂O₅⁺⁺⁺⁺, citrate, C₂O₄^{''}, and certain coloured ions must be absent. F⁻ causes low results, and its effect can be utilised in determining F. The method for Fe⁺⁺⁺ can be applied to low-Fe waters, and to ores containing as much as 50% of Fe. Vals. obtained volumetrically for the latter agree with those obtained by using (I). L. S. T.

Determination of metallic iron in iron oxides and slags.—See B., 1941, I, 550.

Polarographic analysis of aluminium and its alloys.—See B., 1941, I, 557.

Ceric sulphate in oxidimetric titrations. E. E. Halls (*Ind. Chem.*, 1941, 17, 274—277).—The use of Ce(SO₄)₂ in volumetric determinations of Sb⁺⁺⁺, As⁺⁺⁺, Pb₂O₄, PbO₂, Ca⁺⁺ and C₂O₄^{''}, Cr⁺⁺⁺, Fe⁺⁺⁺, Fe(CN)₆⁺⁺⁺⁺, Mo^v, NO₂⁺, Na⁺, Hg⁺, TeO₃^{''}, Ti⁺⁺⁺, U^{iv}, VO⁺⁺, N₃H, quinol, α -keto-acids, and carbohydrates is reviewed. L. S. T.

XI.—APPARATUS ETC.

Optical Dewar vessel. P. G. Strelkov (*J. Physics U.S.S.R.*, 1940, 3, 175—176).—A Dewar vessel fitted with two double parallel glass windows for observation of the contents by transmitted light is described. L. J. J.

Interference spectroscopy. I. K. W. Meissner (*J. Opt. Soc. Amer.*, 1941, 31, 405—427).—The Fabry-Perot interferometer is described, and its application to the resolution and measurement of hyperfine spectral structure discussed. L. J. J.

Lundegårdh flame method of spectrographic analysis. V. R. Ells (*J. Opt. Soc. Amer.*, 1941, 31, 534—542).—In the method described, a solution of the ashed substance (e.g., plant material or soil) in dil. HCl is atomised in an air stream and mixed with C₂H₂ before passing to a burner. The spectral region 3250—4600 Å. is photographed and the line intensities of the elements are compared with those given by standard solutions or with the C₂H₂ flame background. The sensitivity is <10⁻⁴M. for the alkali and alkaline-earth metals and a no. of other elements, and most of the detectable elements can be determined with an accuracy of \pm <5% of the amount present. L. J. J.

High-frequency spark discharge for local micro-analysis. W. M. Murray, jun., B. Gettys, and S. E. Q. Ashley (*J. Opt. Soc. Amer.*, 1941, 31, 433—438).—In the method described, a highly localised high-frequency spark is caused to traverse systematically the surface of a metallic specimen, and the local composition of the surface is correlated with the spectral character of the light emitted. L. J. J.

Construction and use of X-ray powder cameras. A. J. Bradley, H. Lipson, and N. J. Petch (*J. Sci. Instr.*, 1941, 13, 216—219).—The 19-cm. camera described consists of a circular base (with a light-tight cover) to which are attached two channelled blocks, one carrying the collimator system and the other acting as a trap to catch the undeflected beam. A perforated flanged plate mounted on the blocks forms with the base a cylinder on the surface of which the film is mounted and carries the bearing for the rotating specimen holder. In the 35-cm. camera, embodying the same principles, evacuation is provided for. Moreover, since the films would be unduly long, intermediate knife-edges are used and four pieces of film are inserted. A. A. E.

Achromatic reflexion microscope for use with visible or ultra-violet light. B. K. Johnson (*Proc. Physical Soc.*, 1941, 53, 714—719; cf. A., 1940, I, 132).—The instrument described is developed from a design previously reported (cf. A., 1935, 188). An aluminised parabolic mirror and a LiF-SiO₂ objective are employed, and the calc. aberration vals. are given. N. M. B.

Physical photometer. R. P. Teele (*J. Res. Nat. Bur. Stand.*, 1941, 27, 217—228).—The photometer described consists of three elements: (i) a luminosity filter which has a relative spectral transmission similar to that of the average human eye, (ii) a thermopile, and (iii) a sensitive potentiometer. The stability of the receiver is such that the response to a given density of luminous flux does not vary >0.2% from the average during 6 months. The application of the photo-

meter to the measurement the candlepower of lamps is discussed. C. R. H.

Correcting spherical error of electron lenses, especially of those employed with electron microscopes. R. Kompfner (*Phil. Mag.*, 1941, [vii], 32, 410—416).—The error is avoided by introduction of a spherical double grid, supplied with high-frequency a.c., which concentrates an intermittent electron beam on the object and causes the velocity of the electrons to increase with their distance from the lens axis. The method, which is discussed theoretically, also permits correction for chromatism of the irradiating electrons. A. J. E. W.

Stereo-supermicroscopy with the universal electron microscope. M. von Ardenne (*Naturwiss.*, 1940, 28, 248—252).—The electron microscope is particularly well suited for stereoscopic work. The various methods by which the stereoscopic images can be formed are described, and examples of the use of the method are given. A. J. M.

Multiple electrode system for potentiometric titration studies. H. A. Frediani and W. E. Varren (*Ind. Eng. Chem. [Anal.]*, 1941, 13, 646—647).—A flexible multi-electrode system, consisting of one reference electrode (AgCl or Hg₂Cl₂) and 18 indicator electrodes, is used to determine the optimum system for any given determination. Electrodes, electrode support, and electrode assembly are described. L. S. T.

Effect of temperature on the resistance of selenium rectifiers. P. V. Scharavski (*J. Physics U.S.S.R.*, 1940, 3, 379—384).—The variation of the resistance of Se rectifiers over the range 65° to -183° has been determined. The effect in the direction in which the current will flow is \ll that for Cu₂O rectifiers. The temp. coeff. of resistance of the rectifying Se layer is negative at low potentials and positive at high potentials (>20 v.). The transition temp. between positive and negative coeffs. rises with increasing potential. Modern theories of the action of rectifying layers are discussed, and it is shown that they give a qual. explanation of the observed temp. coeff. of resistance. A. J. M.

Completely automatic emanation apparatus. K. E. Zimens (*Z. physikal. Chem.*, 1940, A, 186, 94—104).—Apparatus is described which produces and records emanation-temp. curves. Curves are given for mixed crystals of BaCO₃-CaCO₃, amorphous silicic acid, and magnetite. The process can record rapid changes in emission of emanation, and has many advantages over the electrostatic methods of determining ionisation. A. J. M.

Proton accelerator for irradiation of living matter.—See A., 1941, III, 1086.

Silvering of glass: effect of organic acids on formation of a silver mirror.—See B., 1941, I, 546.

Apparatus for Kjeldahl determination of nitrogen in coal.—See B., 1941, I, 524.

Apparatus and methods for precise fractional distillation analysis. Adiabatic fractionating column and precision-spaced wire packing for temperature range -190° to 300°. W. J. Podbielniak (*Ind. Eng. Chem. [Anal.]*, 1941, 13, 639—645).—The column described and illustrated is satisfactory over the range -190° to 300° with extended use of vac. jacketing around the column, flask, reflux, and all connexions. New vac.-jacketed standard-taper ground joints withstand liquid air temp. and temp. of 300°. Flexible glass bellows are used as expansion joints. A new form of precision-spaced wire packing has also been developed. Performance data are recorded for *n*-C₇H₁₆ and methylcyclohexane, and the application of the column and packing to low- and high-temp. fractionation is described. L. S. T.

Laboratory condenser. M. T. Bush (*Ind. Eng. Chem. [Anal.]*, 1941, 13, 592).—The double spiral condenser illustrated is made of Pyrex glass, and can be used with H₂O, ice, or solid CO₂ for downward distillation and refluxing. L. S. T.

Potentiometric titration stand assembly. L. Lykken and F. B. Rolfson (*Ind. Eng. Chem. [Anal.]*, 1941, 13, 653—655).—The apparatus described and illustrated is suitable for most routine electrometric titrations. Adaptations to semi-micro-determinations is also described. L. S. T.

Magnetic stirrer for use in the cup type of moisture-transfusion apparatus. H. K. Burr and H. J. Stamm (*Ind. Eng. Chem. [Anal.]*, 1941, 13, 655). L. S. T.