BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

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

AUGUST, 1941.

I.—SUB-ATOMICS.

Interaction of atomic energy levels. T. S. Subbaraya, K. Seshadri, and N. A. N. Rao (*Current Sci.*, 1941, **10**, 71—74).—Lines of Sn and Hg which undergo modification in intensity on admixture of Sn and Hg are given and probable explanations are advanced (cf. A., 1940, I, 305). W. R. A.

Carbon arc spectra of europium, gadolinium, and samarium in small quantities. J. M. López de Azcona (*Anal. Fís. Quím.*, 1941, **37**, 30—47).—The persistence of arc lines between 2200 and 5000 A. for these elements in quantities of 2×10^{-4}, 2×10^{-5}, 2×10^{-6}, and 2×10^{-7} g. is studied. The nos. of persistent lines observed are respectively: for Eu, 231, 33, 13, 3; for Gd, 310, 112, 16, 1; and for Sm, 425, 172, 21, —. Tables of persistent lines and of ultimate lines are given. F. R. G.

Electron emission of metals in electric fields. I. Explanation of the periodic deviations from the Schottky line. E. Guth and C. J. Mullin (*Physical Rev.*, 1941, [ii], **59**, 575—584; cf. Seifert, A., 1939, I, 589).—Mathematical. The deviations observed in measuring the thermionic emission of electrons from W and Ta are attributed to the partial reflexions of the electron waves on the potential hill at the surface of the metal giving rise to interference and thus to a periodic term in the transmission coeff. for the escaping electrons. The calc. positions of the max. and min. and the independence of temp. agree with observation; the amplitude decreases with rise of temp. The calc. amplitude of the deviations increases with the field, as does the observed amplitude. A dependence on the work function of the emitting metal is obtained. N. M. B.

Calorimetric method of measurement of loss of energy of fast electrons in lead, due to radiation. K. D. Sinelnikov, A. K. Valter, and A. V. Ivanov (*Bull. Acad. Sci. U.R.S.S., Sér. Phys.*, 1940, **4**, 273—278).—Apparatus is described, depending on comparison of heat production in a Li and a Pb vac. calorimeter during exposure to a monochromatic electron beam. The results are in agreement with those calc. from the theory of Bethe *et al.* (A., 1934, 1150). R. T.

Ionisation by meteors. J. A. Pierce (*Physical Rev.*, 1941, [ii], **59**, 625—626).—Experimental evidence of atm. ionisation by meteoric bombardment is presented and discussed. N. M. B.

Joint action of diffusion and recombination of ions. G. Jaffé (*Physical Rev.*, 1941, [ii], **59**, 652—658).—Mathematical. The differential equation which describes the joint action of diffusion and recombination of ions is solved for the one-dimensional case. The decay of a given initial distribution of ions and the establishment of the steady state are treated. Anomalies observed by Gardner (cf. A., 1938, I, 110) in the recombination coeff. of O_2, and in the establishment of the steady state in air, are explained by diffusion to the walls. N. M. B.

Energy loss of heavy ions. J. Knipp and E. Teller (*Physical Rev.*, 1941, [ii], **59**, 659—669).—The energy loss of heavy ions is due to collisions with electrons and with nuclei. The first process is essentially determined by the ionic charge, which in turn depends on the ratio of the velocities of the most loosely-bound electron within the ion, and of the ion. The former velocity is calc. from the Thomas–Fermi model, and the ratio of the two velocities is adjusted to empirical data. The nuclear contribution to the stopping cross-section is calc. by the classical method. Comparative experimental and calc. data are plotted throughout. N. M. B.

Low-velocity hydrogen-ion scattering in hydrogen, water, and ammonia. A. S. Russell, C. M. Fontana, and J. H. Simons (*J. Chem. Physics*, 1941, **9**, 381—387).—The effective cross-sections for scattering of H_2, H_2O, and NH_3 for low-velocity protons, and of H_2 for low-velocity H_2^+ and H_3^+, have been determined. The source of low-velocity H^+ was an arc in H_2, the construction of which, with the circuit in which it is used, is described. The effective cross-sectional area was reasonably independent of pressure over the pressure range used. The average force laws can be calc., and the energy of combination for H_2 and NH_3 can be estimated. A val. of 3·5 e.v. is obtained for the proton affinity of H_2, and 9·4 e.v. for that of NH_3, assuming that the law of force holds down to the equilibrium positions. These vals. agree well with previous estimates by other methods. No curve could be obtained for the scattering of H_2^+ in H_2, but it is known that there is a large interaction. A. J. M.

Arc discharge in mercury. B. Dasannacharya and C. Dakshinamurti (*Current Sci.*, 1941, **10**, 166—167).—Voltage–current (V–I) characteristics are given for a d.c. arc (pressure $p = 0·5$ mm.) with varying degrees of air cooling. Without cooling V is approx. $\propto I$, but with cooling the rising characteristic is preceded by a rapid fall in V which becomes more pronounced as cooling is increased; the min. V val. ($\sim$23·5 v.) is approx. const., but the corresponding I val. increases with cooling. With $p < 0·2$ mm. the falling characteristic cannot be obtained, but curves for an uncooled arc with $p = 1·5$—8·0 mm. show a min. which moves to higher V and I vals. as p increases. A. J. E. W.

Studies in mineral metabolism with the aid of artificial radioactive isotopes. VI. Cobalt.—See A., 1941, III, 526.

Performance of the Radium Institute cyclotron of the Academy of Science, U.S.S.R. I. V. Kurtschatov (*Bull. Acad. Sci. U.R.S.S., Sér. Phys.*, 1940, **4**, 372—375).—Results obtained with this cyclotron are described. R. T.

New applications of induced radioactivity. S. Z. Roginski (*Bull. Acad. Sci. U.R.S.S., Sér. Phys.*, 1940, **4**, 350—352).—A review. R. T.

Ionisation of atoms and formation of pairs in nuclear reactions. A. B. Migdal (*Bull. Acad. Sci. U.R.S.S., Sér. Phys.*, 1940, **4**, 287—289).—Mathematical. Expressions of the probability of ionisation during radioactive decay are derived. R. T.

Excitation of γ-rays by fast neutrons of different energy. I. Nonaka (*Physical Rev.*, 1941, [ii], **59**, 681).—Using 2·25—2·90-Me.v. fast neutrons from a D–D source, at. cross-section curves of Al, Si, Fe, Co, Cu, Ag, Cd, and Pb for γ-ray excitation were obtained. Results are discussed with reference to available data. N. M. B.

Absorption of fast neutrons. V. S. Dementii and D. V. Timoschtschuk (*Bull. Acad. Sci. U.R.S.S., Sér. Phys.*, 1940, **4**, 315—316).—Absorption of fast neutrons from a Ra–Be source by cylindrical or plane screens of various elements (Al, Si, S, Mn, Fe, Cu, Zn, Rh, Ag, Sb, Te, W, Au) has been studied. Effective cross-sections of the (n, γ) reaction increase with increasing at. wt. of the element; this reaction appears to be due to slow neutrons. Absorption associated with the (n, α) and (n, p) reactions is of the same order of magnitude as scattering, in the case of light nuclei. R. T.

Absolute cross-section for the photo-disintegration of deuterium by 6·2-Me.v. quanta. J. A. Van Allen and N. M. Smith, jun. (*Physical Rev.*, 1941, [ii], **59**, 618).—Measurements with a high-pressure ionisation chamber filled with D_2 gas

give a corr. weighted average val. of $11{\cdot}6 \pm 1{\cdot}5 \times 10^{-28}$ sq. cm. This is approx. equal to that of the Bethe–Peierls theory for zero force range ($12{\cdot}6 \times 10^{-28}$) and is distinctly < that predicted by any present theory when based on a reasonable val. for the force range. N. M. B.

Deuteron bombardment of oxygen. S. B. Welles (*Physical Rev.*, 1941, [ii], **59**, 679).—Two WO_3 targets, one containing O_2 and the other an equal amount of O_2 enriched in $^{17}O_2$ and $^{18}O_2$, were bombarded with 3·7-Me.v. deutrons, and the intensity of 114-min. activity of ^{18}F was measured. The increase for the enriched target amounted to a factor of 19, agreeing with an expected enrichment factor of ~20 for ^{17}O, on account of the more rapid approach to concn. equilibrium of ^{17}O, rather than 9, as would be indicated by the separation factor 81 of ^{18}O. N. M. B.

Nuclear isomerism of bromine. L. I. Rusinov and A. A. Juzefovitsch (*Bull. Acad. Sci. U.R.S.S., Sér. Phys.*, 1940, **4**, 320—326).—γ-Radiation of *Br has $\lambda = 1$ mμ., corresponding with the $K\alpha$ line of the X-ray spectrum of Br. The absorption coeffs. of the radiation are of the same order of magnitude in Pb and Hg, showing that the reaction is $*\text{Br-I} \xrightarrow{\gamma} *\text{Br-II} \xrightarrow{\beta} \text{Br}$, but not $*\text{Br-I} \xrightarrow{\beta} *\text{Kr} \xrightarrow{\gamma} \text{Br}$ The results are in accordance with Bohr's theory of nuclear isomerism. The excitation energy of the metastable nucleus and its internal conversion coeff. are determined. R. T.

Metastable state of the gadolinium nucleus. I. V. Kurtschatov (*Bull. Acad. Sci. U.R.S.S., Sér. Phys.*, 1940, **4**, 327—329).—Capture by Gd of neutrons slowed by paraffin leads to formation of unstable nuclei, which undergo internal transformation with emission of electrons of energy ~100 ke.v. R. T.

Phase transformations of nuclear matter. I. I. Gurevitsch (*Bull. Acad. Sci. U.R.S.S., Sér. Phys.*, 1940, **4**, 330—331).—Abrupt changes in the energy parameters of at. nuclei take place at certain definite temp. This is ascribed to phase transformations of nuclear matter. R. T.

Radioactivity of ^{56}Mn and ^{128}I. R. H. Bacon, E. N. Grisewood, and C. W. van der Merwe (*Physical Rev.*, 1941, [ii], **59**, 531—538).—In order to eliminate discrepancies in existing data, the β-ray spectra and accompanying γ-rays were examined with crit. regard to difficulties of cloud-chamber technique. Results appear to fit the Fermi rather better than the Konopinski–Uhlenbeck theory. N. M. B.

Statistics of excited energy states of nuclei. H. Margenau (*Physical Rev.*, 1941, [ii], **59**, 627—632).—Using a model of free particles moving in a spherical well, the spacing of nuclear energy levels at excitation energies of ~8 Me.v. is calc. by numerical summation over the individual particle states, thus avoiding the use of asymptotic Sommerfeld formulæ of doubtful validity for nuclear cases. Results indicate that deviations from Bethe's formula for the level density can be very great. The group structure introduced by the free-particle model has a strong effect on the spacing. The fluctuations explain the general absence, contrary to current theory, of the property of strong absorption of slow neutrons by heavy nuclei. N. M. B.

Fission of [atomic] nuclei. A. I. Leipunski (*Bull. Acad. Sci. U.R.S.S., Sér. Phys.*, 1940, **4**, 291—299).—A review. R. T.

Ranges and energy of uranium fragments arising from nuclear fission under bombardment with fast neutrons. K. A. Petrshak (*Bull. Acad. Sci. U.R.S.S., Sér. Phys.*, 1940, **4**, 301—304).—Fission of U nuclei following capture of fast neutrons leads to production of two groups of fragments, range 14 and 20 mm. in air, and energies 60 and 85 Me.v., respectively. R. T.

Chemical nature of products of fission of heavy nuclei. V. G. Chlopin (*Bull. Acad. Sci. U.R.S.S., Sér. Phys.*, 1940, **4**, 305—309).—The following schemes of β-degradation of $_{92}$U are probable: Mo ← Nb ← U → Sb → Te → I → Xe → Cs → Ba → La → Ce; Pr ← Ce ← U → Se → Br → Kr → Rb → Sr → I → Zr. R. T.

Fission of uranium. L. I. Rusinov and G. N. Flerov (*Bull. Acad. Sci. U.R.S.S., Sér. Phys.*, 1940, **4**, 310—314).—Fission of U by thermal neutrons is associated with emission of 2—4 secondary neutrons. Resonance neutrons do not cause fission. Only $^{235}_{92}$U is affected by thermal neutrons. R. T.

Fission products of uranium by fast neutrons. Y. Nishina, T. Yasaki, K. Kimura, and M. Ikawa (*Physical Rev.*, 1941, [ii], **59**, 677).—Experiments are described showing that the recently reported (cf. A., 1941, I, 189) decay curve of Ru (60 hr.) was in reality the superposition of the growth and decay curve of Rh (34 hr.) produced from Ru (4 hr.) and the decay curve of a Ru isotope of a few months' period. N. M. B.

Fission of uranium by α-particles. E. Fermi and E. Segrè (*Physical Rev.*, 1941, [ii], **59**, 680—681).—A thin layer of NH_4 uranate was bombarded with 32-Me.v. α-particles from a cyclotron. Chemical tests revealed the presence of the following fission products of U: I (54 min. and 3·4 hr.), ^{133}I (22 hr.), and ^{131}I (8 days). A compound nucleus of U and α-particles would probably be 5—10 Me.v. < the kinetic energy of the α-particle, leaving an excitation amply sufficient to produce fission of the compound nucleus. N. M. B.

Nature and constitution of cosmic radiation. D. V. Skobeltzyn (*Bull. Acad. Sci. U.R.S.S., Sér. Phys.*, 1940, **4**, 233—247).—A review of current theories shows that they are in many respects contradictory. R. T.

Number of decay electrons accompanying penetrating corpuscular radiation. K. I. Alexeeva (*Bull. Acad. Sci. U.R.S.S., Sér. Phys.*, 1940, **4**, 248—253).—The soft components of radiation generated by decay electrons in the atm., not penetrating a thickness of wood equiv. to 160 cm. of H_2O, amount to $\not> 8\% \pm 2$ of total penetrating radiation. R. T.

Cascade theory and experimental data. S. N. Vernov (*Bull. Acad. Sci. U.R.S.S., Sér. Phys.*, 1940, **4**, 254—259).—Discrepancies between experimental results for transmission of cosmic radiation through air and Pb and those expected on the basis of the cascade theory of Bhabha and Heitler (A., 1937, I, 440) are removed by introducing corrections for scattering and for the presence of particles of penetrating power > that allowed for in the theory. R. T.

Slow mesotrons in cosmic radiation. V. I. Veksler and N. A. Dobrotin (*Bull. Acad. Sci. U.R.S.S., Sér. Phys.*, 1940, **4**, 260—265).—Measurements at sea level and at 4200 m. show the presence of two groups of particles which ionise more intensely than do fast electrons. One group increases with altitude, and consists of slow secondary mesotrons, whilst the second group consists of slow protons. R. T.

Peculiarities of splitting of atomic nuclei by cosmic rays. A. P. Shdanov (*Bull. Acad. Sci. U.R.S.S., Sér. Phys.*, 1940, **4**, 266—272).—Heavy charged particles produce characteristic tracks in photographic emulsions. Most of the tracks are due to protons originating from nuclei split by cosmic rays, but tracks due to α-particles also appear. Showers of protons or of protons and mesotrons were also observed, consisting in most cases of 3—4 particles, although in one case > 100 particles were counted. The rate of splitting rises rapidly with increasing altitude. R. T.

Production of hard corpuscular radiation. F. F. Lange and V. S. Schpinel (*Bull. Acad. Sci. U.R.S.S., Sér. Phys.*, 1940, **4**, 353—366).—A review. R. T.

Motion of mesons in electromagnetic fields. I. Tamm (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 551—555).—Mathematical. The motion of a charged particle of spin 1 in a Coulomb field and its interaction with high-frequency photons depend on the size of the particle, whilst the opposite is true for a particle with spin 0 or $\frac{1}{2}$. This arises from the fact that, unlike electrons, the particles with spin 1 (mesons) possess what is defined as a true magnetic moment. W. R. A.

Secondary mesons. V. I. Veksler and N. A. Dobrotin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 560—562).—The ranges of secondary mesons are small and hence their kinetic energy contributes only a small fraction of the total energy. W. R. A.

Differential measurement of the meson lifetime. W. M. Nielsen, C. M. Ryerson, L. W. Nordheim, and K. Z. Morgan (*Physical Rev.*, 1941, [ii], **59**, 547—553).—Measurements were made by comparing the Pb absorption curves of cosmic radiation at two different elevations, and by compensating the air column at the higher level by a layer of graphite on top of the counter telescope. Results are independent of the energy distribution or of the height of the producing layer. The val.

found is $(1{\cdot}25 \pm 0{\cdot}3) \times 10^{-6}$ ($\mu c^2/10^8$ e.v.) sec., which is < available data (cf. Rossi, A., 1940, I, 187; Neher, *ibid.*). N. M. B.

Nature of the meson decay. L. W. Nordheim (*Physical Rev.*, 1941, [ii], **59**, 554—555).—In view of the smaller new val. of the meson lifetime (cf. preceding abstract), theoretical vals. for the intensity of the soft component due to meson decay are compared with experimental data. N. M. B.

Mean life of slow mesotrons. F. Rasetti (*Physical Rev.*, 1941, [ii], **59**, 613).—A preliminary report of a new arrangement of counters to measure a decay curve of mesotrons at rest; the resulting val. is $3{\cdot}1 \pm 1{\cdot}5$ μ-sec. N. M. B.

Fine structure pattern of cosmic rays at Mexico City. II. E. J. Schremp and A. Baños, jun. (*Physical Rev.*, 1941, [ii], **59**, 614).—Results previously reported (cf. A., 1941, I, 3) are extended, and features of the intensity pattern and properties of the radiation are deduced and discussed. N. M. B.

Nature of the primary cosmic radiation and the origin of the mesotron. M. Schein, W. P. Jesse, and E. O. Wollan (*Physical Rev.*, 1941, [ii], **59**, 615; cf. A., 1940, I, 308).—The intensity curve of the hard component for various Pb thicknesses as a function of pressure shows a continuous intensity increase to the highest altitudes. Several lines of evidence indicating that the primary cosmic radiation consists of protons, and not of electrons or mesotrons, are reported and discussed. N. M. B.

Burst production by mesotrons of spin one-half and zero magnetic moment. S. B. Batdorf and R. Thomas (*Physical Rev.*, 1941, [ii], **59**, 621—624).—Mathematical. The cross-section for the initiation of energetic cascades or bursts by bremsstrahlung is calc. for a mesotron of spin $\frac{1}{2}$ or 0 magnetic moment. Results are similar to Christy's for a Proca particle, the cross-section being $\sim 0{\cdot}7$ of that recorded (cf. A., 1941, I, 235). N. M. B.

Geomagnetic character and cosmic-ray intensity pulses. J. W. Broxon (*Physical Rev.*, 1941, [ii], **59**, 678—679).—A close relationship between the pulses in cosmic-ray intensity and terrestrial magnetic disturbances has been discovered by application of Chree's method of geomagnetic analysis. N. M. B.

Neutrino theory of stellar collapse. G. Gamow and M. Schoenberg (*Physical Rev.*, 1941, [ii], **59**, 539—547).—Mathematical. A theory of neutrino energy losses in contracting stars is proposed, and a formula for the rate of these losses as a function of temp. and density is developed (see also following abstract). N. M. B.

Relative importance of different elements for neutrino production. G. Gamow (*Physical Rev.*, 1941, [ii], **59**, 617—618).—A diagram is constructed to show the relative importance of different elements for the energy losses through neutrino emission in contracting stars (cf. preceding abstract) taking into account the abundance of the elements and the known decay energies and decay periods of the corresponding unstable nuclei. The effect of different factors on the rate of energy losses is discussed. N. M. B.

Exchange properties of the neutron–proton interaction. W. Rarita and J. Schwinger (*Physical Rev.*, 1941, [ii], **59**, 556—564; cf. A., 1941, I, 236).—Mathematical. Information on the interaction in odd parity states can be gained only by observations on high-energy neutron–proton scattering and deuteron photo-disintegration by energetic γ-rays. Calculations are made for three types of interactions, analogous to the potentials predicted by "symmetrical," "charged," and "neutral" mesotron theory, in order to test the sensitivity of such experiments to variations of the exchange operator dependence of the interaction. Results for total cross-sections and angular distributions in the centre of mass system are given, as well as the electric dipole total cross-sections and angular distributions predicted by the three theories. High-energy photo-disintegration angular measurements constitute the most sensitive test of isotopic spin dependence of the neutron–proton interaction and the existence of non-central forces. N. M. B.

Non-uniform particle density in nuclear structure. E. Feenberg (*Physical Rev.*, 1941, [ii], **59**, 593—597).—Mathematical. A variation of the proton density within a nucleus due to Coulomb repulsion between protons creates forces which distort the neutron distribution. Neglecting surface effects, the energy correction associated with the non-uniform densities is calc. The departure from uniform density is appreciable in heavy nuclei, but the energy correction is negligible. N. M. B.

Interaction of electrons in metals and insulators. C. W. Ufford (*Physical Rev.*, 1941, [ii], **59**, 598—608).—Mathematical. The electrostatic energy of electrons in a lattice is calc. by the Rayleigh–Schrödinger perturbation method. For a metal, this method gives a val. which becomes logarithmically infinite; for an insulator the gap in energy above the first occupied zone leads to a finite result. N. M. B.

Einstein condensation phenomenon. W. E. Lamb, jun., and A. Nordsieck (*Physical Rev.*, 1941, [ii], **59**, 677).—An application of the results of Goldstein (cf. A., 1941, I, 236) to the case of a gas in a gravitational field. N. M. B.

An aspect of the materialisation of energy according to Dirac's theory. O. R. Foz (*Anal. Fís. Quím.*, 1941, **37**, 22—24).—Dirac's theory is considered to be equiv. to the photon emission accompanying the transference of an electron from one energy level to another. F. R. G.

II.—MOLECULAR STRUCTURE.

Intensity measurements in the molecular spectrum of hydrogen. N. Ginsburg and G. H. Dieke (*Physical Rev.*, 1941, [ii], **59**, 632—644).—Quant. intensity measurements of the H_2 spectrum in the visible and infra-red were made for different conditions in the discharge tube, and data for the Fulcher bands are reported. At the lower pressures no equilibrium appears to exist and hence the concept of temp. has no meaning. By varying the pressure and current in the discharge tube the effective rotational temp. can be varied from 240° to 1500° K. Whereas higher rotational states are favoured by an increase in pressure, the higher vibrational states are suppressed, and this effect is largely independent of the current. From the behaviour of the relative intensities with changes of pressure and c.d. conclusions can be drawn regarding the elementary processes in the discharge. Results show the need for extreme care when using band-spectra intensity measurements for temp. measurements, and that transition probabilities may be quite different from the vals. predicted by elementary theory. N. M. B.

New ($2 \rightarrow 2$) band in the spectrum of OD. A. L. Narayan (*Current Sci.*, 1941, **10**, 75).—In the region 3100—3250 A. 200 lines of the band system of OD have been measured precisely; 90 of them form the six principal branches of the new $2 \rightarrow 2$ band. W. R. A.

Band spectrum of sodium hydride. R. C. Pankhurst (*Nature*, 1941, **147**, 643).—New bands of NaH have been measured in the region $\lambda\lambda$ 4900—6400. Rotational consts. are recorded for the lower levels ($v' = 1, 2, 3$) of the upper state and for levels of the ground state. L. S. T.

Vibrational structure of the $^2\Sigma_g^+ \leftarrow {}^1\Sigma_g^+$ Rydberg series of N_2. Y. Tanaka and T. Takamine (*Physical Rev.*, 1941, [ii], **59**, 613).—In the region 938—784 A., twelve (1,0) bands of the Worley–Jenkins series (cf. A., 1938, I, 543) were found. The limit of the (1,0) bands lies at 782·26 A., or 15·77 v. N. M. B.

New absorption spectra of the alkaline-earth fluorides. C. A. Fowler, jun. (*Physical Rev.*, 1941, [ii], **59**, 645—652).—Investigation under high dispersion reveals several new band systems in the ultra-violet as far as 1950 A. Wave-no. residuals and estimated intensities are tabulated. Vibrational analyses give the vibration frequencies and electronic terms of one new state of MgF, 3 of CaF, 4 of SrF, and 4 of BaF. Previous analyses of the $A \rightleftharpoons X$ system of MgF and the $C \rightleftharpoons X$ system of CaF are revised. An increased binding in all these higher-energy states as indicated by the vals. of the consts. is discussed with reference to the probable electron configurations. N. M. B.

Visible absorption bands of mercuric chloride. A. L. S. Rao (*Current Sci.*, 1941, **10**, 169).—A system of doublet bands at 4200—4900 A., containing three well-defined sequences, has been observed in the absorption spectrum of $HgCl_2$ vapour at 1000°. The bands are ascribed to HgCl, and probably form part of Wieland's class III system (cf. A., 1929, 1127; 1930, 652; 1932, 981). A. J. E. W.

Ultra-violet emission bands of mercuric chloride. M. G. Sastry (*Current Sci.*, 1941, **10**, 169).—A detailed analysis of the band system at 2700—2900 A. (Wieland; cf. preceding abstract) confirms its assignment to HgCl, and a previous vibrational analysis (Cornell, A., 1938, I, 551). Bands forming the Q_2 sequences of the system have been observed on the short-λ side of the Q_1 sequences, the doublet separation being ~90 cm.$^{-1}$ The system is ascribed to a $^2\Pi - {}^2\Sigma$ transition, the lower state of which is probably identical with that of Wieland's class I system. Vibrational consts., derived from the Q_2 heads, are: ω_e' 287·8, ω_e'' 281·0, $x_e'\omega_e'$ 0·5, $x_e''\omega_e''$ 0·5; ν_e is 36,564·2. A. J. E. W.

Near infra-red spectrum of water vapour. I. Perpendicular bands of ν_2 and $2\nu_2$. H. H. Nielsen (*Physical Rev.*, 1941, [ii], **59**, 565—575; cf. Randall, A., 1937, I, 495; Darling, A., 1940, I, 146).—Remeasurement data for the rotation–vibration ν_2 and $2\nu_2$ bands in the bolometric infra-red, and an analysis of the rotational structure, are reported. The calc. normal frequency ν_2 is 1653·8 cm.$^{-1}$, and the anharmonic const. U_{22} is −19·25 cm.$^{-1}$ Vals. of the moments of inertia effective in the two vibration states are given. Results confirm the theory of the H_2O vapour mol. N. M. B.

Infra-red spectra of SiH_4 and GeH_4. C. H. Tindal, J. W. Straley, and H. H. Nielsen (*Proc. Nat. Acad. Sci.*, 1941, **27**, 208—212).—An extension of previous work (A., 1941, I, 71). Vals. for SiH_4 and GeH_4 respectively are: ν_2, 975 and 932; ν_3, 2191 and 2114; ν_4, 910 and 818 cm.$^{-1}$ These lead to vals. of 0·997 and 1·059 × 10^{-39} g.-cm.^{2} respectively for the moments of inertia and 1·50 and 1·54 × 10^{-8} cm. respectively for the X—H distance. W. R. A.

Raman effect in gypsum. D. A. A. S. N. Rao (*Proc. Indian Acad. Sci.*, 1941, **13, A**, 137—149).—The Raman spectrum of gypsum contains six frequencies with shifts 415, 491, 617, 673, 1006, and 1132 cm.$^{-1}$ due to SO_4'' and two bands at 3405 and 3489 cm.$^{-1}$ due to H_2O of crystallisation. The appearance of so many lines does not imply a lack of tetrahedral symmetry in the SO_4 group but may be ascribed to the low degree of symmetry possessed by the crystal itself. In 12 spectrograms corresponding with different orientations of the crystal, the total symmetric line 1006 cm.$^{-1}$ is always nearly the strongest, and the lattice lines do not appear with sufficient intensity in any case; this behaviour is characteristic of this crystal. The total symmetric line is depolarised to an appreciable extent in all the cases. The behaviour of the 1132 cm.$^{-1}$ line is reciprocal to that of 1006 cm.$^{-1}$ in almost all the cases. The behaviour of the 3405 and 3489 cm.$^{-1}$ bands is reciprocal. These and the 1006 and 1132 cm.$^{-1}$ lines belong respectively to the symmetric and antisymmetric classes. H. W.

Spectroscopic evidence for hydrogen bonds: comparison of proton-attracting properties of liquids. IV. W. Gordy (*J. Chem. Physics*, 1941, **9**, 440).—A correction (A., 1941, I, 239). A. J. M.

Hindered rotation in halogenated ethanes. G. Glockler and C. Sage (*J. Chem. Physics*, 1941, **9**, 387—389).—The Raman spectra of some halogenoethanes have been investigated. The results show that if only "staggered" (as opposed to "eclipsed") forms are regarded as stable configurations, the compounds can be divided into three groups: (1) those which may have only one mol. configuration, $CF_3{\cdot}CCl_3$ and $CCl_3{\cdot}CHFCl$; (2) those which may have two rotational isomerides, $(CF_2Cl)_2$, $CF_2Cl{\cdot}CFCl_2$, $CF_2Cl{\cdot}CHF_2$, and $(CF_2Br)_2$; (3) those which may have three rotational isomerides, $CF_2Br{\cdot}CFClBr$ and $CF_2Cl{\cdot}CHFCl$. The no. of observed lines increases as the no. of possible isomeric forms increases, although there is not complete correspondence between the theoretical no. of active vibrations and the no. of observed lines. This may be due to some of the lines being overtones or combination frequencies, to the fact that the isomerides may be present in such small concn. that only the more intense lines are obtained, and to some of the frequencies being nearly the same for all isomerides. The valency vibrations are not appreciably affected by the rotational orientation of the two halves of the mol. A. J. M.

Raman spectra of acetylenes. IV. Carbon isotope effect in acetylenes. F. F. Cleveland and M. J. Murray (*J. Chem. Physics*, 1941, **9**, 390—392).—The C isotope shift in the frequency near 2200 cm.$^{-1}$ has been calc. for $^{13}CH{:}^{12}CH$, $^{12}CMe{:}^{13}CH$, $^{13}CMe{:}^{12}CH$, and $^{13}CMe{:}^{12}CMe$, using the same potential function in each case, and assuming a four-mass linear oscillator. The calc. shifts were −27, −26, −50, and −33·5 cm.$^{-1}$, respectively. It is probable that the magnitude of isotope shifts in other mono-substituted acetylenes will be nearly the same as those calc. for the methylacetylenes. Weak lines which may correspond with isotope shifts were actually found for the mono-substituted acetylenes Δ^α-heptine (−21 and −53 cm.$^{-1}$), δ-methoxy-Δ^α-butine (−24 and −53 cm.$^{-1}$), and CPh:CMe (−24 and −54 cm.$^{-1}$), and for the disubstituted acetylenes α-phenyl-Δ^α-butin-γ-one (−37 cm.$^{-1}$), α-phenyl-Δ^α-butin-γ-ol (−33 cm.$^{-1}$), α-phenyl-Δ^α-butine (−29 cm.$^{-1}$), Δ^γ-hexine (−26 cm.$^{-1}$), Δ^γ-octine (−36 cm.$^{-1}$), and Δ^ϵ-decine (−38 cm.$^{-1}$). A. J. M.

Infra-red absorption spectra of some amino-compounds. L. Kellner (*Proc. Roy. Soc.*, 1941, **A, 177**, 447—456).—The materials examined were glycine (**I**), 2 : 5-diketopiperazine (**II**), tetramethyldiketopiperazine (**III**), glycylglycine (**IV**), and $CO(NH_2)_2$ (**V**). Observations of infra-red spectra were carried out in the range 2·8—3·6 μ. The results are discussed in relation to the mol. structure of the compounds. The no. and position of the N–H frequencies in (**I**) and (**IV**) show that these mols. are in the zwitterion form in the crystal. The similarity between the spectra of (**II**) and (**III**) on the one hand and those of the NH_2-acids and (**V**) on the other proves that no lactam–lactim interchange occurs in (**II**) and (**III**). Both compounds possess a centre of symmetry. In all the substances resonance between C–N and C=O bonds takes place. [For the discussion of the spectrum of (**V**) see following abstract.] G. D. P.

Vibrations and molecular structure of carbamide and guanidonium. L. Kellner (*Proc. Roy. Soc.*, 1941, **A, 177**, 456—475; cf. preceding abstract).—The vibrations of $CO(NH_2)_2$ and $CO(ND_2)_2$, and of $C(NH_2)_3$ and $C(ND_2)_3$, have been calc. for a field containing valency and angle forces. The observed frequencies are assigned to definite modes of vibration and the force consts. are evaluated. In $CO(NH_2)_2$ the C–N bond has approx. 28% double bond character and the C=O a corresponding single bond character. Guanidonium shows complete resonance, each C–N bond being one third double. G. D. P.

Effect of crystal orientation on the Raman effect in naphthalene and benzophenone. T. M. K. Nedungadi (*Proc. Indian Acad. Sci.*, 1941, **13, A**, 161—176).—Single crystals of $C_{10}H_8$ exhibit 4 lattice and 28 internal vibrations (8 new displacements) and those of $COPh_2$ give 3 lattice and 19 internal oscillations (4 new). Molten $COPh_2$ shows 27 lines (6 new), of which 15 are polarised. The influence on the intensities of Raman lines of different crystal orientations and of different directions of incidence and states of polarisation of exciting radiation has been investigated. W. R. A.

Ultra-violet absorption spectra of metallo-porphyrins and their compounds with globin. H. F. Holden (*Austral. J. Exp. Biol.*, 1941, **19**, 1—8).—Data for the ultra-violet absorption spectra of protoporphyrin compounds of Cu, Ni, Co, and Zn in C_5H_5N–$CHCl_3$, EtOH–HCl, and H_2O, and in presence of globin, are given and discussed. F. O. H.

Measurements of dispersion of light by skim milk. W. Lotmar and H. Nitschmann (*Helv. Chim. Acta*, 1941, **24**, 242—247).—Casein of natural skim milk exists as a light-dispersing system at the upper limit of validity of Rayleigh's theory. Addition of alkali causes dispersion of the particles with diminution of the intensity of dispersion to 0·002 and an equally pronounced diminution of particle vol. The val. of the degree of depolarisation indicates an upper limit of ~120 mμ. for the diameter of the particles of neutral skim milk and therefore a limit of ~15 mμ. for those of the alkaline liquid. These data agree satisfactorily with those obtained by ultracentrifuging. The vals. also establish spherical form or at least spherical symmetry for native casein but the shape of these dispersed particles cannot be defined. H. W.

The property $(\delta u/\delta v)_T = 0$ of perfect gases, the second law of thermodynamics, and the fundamental hypothesis underlying kinetico-statistics. O. R. Foz (*Anal. Fis. Quim.*, 1941, **37**, 25—29).—Joule's law is empirical and cannot be derived from the equation of state and the second law of thermodynamics. Possible sources of error in the derivation of thermodynamic theory are discussed, in particular those arising from the application of the classical laws of mechanics to dimensions of the order of mols. F. R. G.

Second virial coefficients of polar gases. W. H. Stockmayer (*J. Chem. Physics*, 1941, **9**, 398—402).—An equation is given for the second virial coeff. of a polar gas in terms of the parameters appearing in the expression for intermol. potential energy, which includes London and dipole attraction and inverse-power repulsion. The equation is applied to NH_3 and steam. The London consts. obtained agree satisfactorily with theoretical estimates. The defects of the model and its relation to the concept of the H bond are discussed in particular connexion with the calculation of the second virial coeff. of steam. A. J. M.

Partition function for normal liquids. J. Walter and H. Eyring (*J. Chem. Physics*, 1941, **9**, 393—397).—A theory of liquids is developed which gives a picture of the rate processes as well as the thermodynamic properties of liquids. It is assumed that the mols. are distributed at random among solid-like and gas-like equilibrium positions. The introduction of a new equilibrium position requires a vol. increase about $\frac{1}{8}$ of the mol. vol. The theory is applied to liquid A, liquid N_2, and C_6H_6, with satisfactory results. It may also be applied successfully to the calculation of the thermodynamic properties of liquid metals. A. J. M.

Alleged dimeric constitution of ethylenediaminocupric chloride. K. L. Mandal (*Current Sci.*, 1941, **10**, 78).—Polemical against Chattaway and Drew (A., 1937, I, 420). W. R. A.

III.—CRYSTAL STRUCTURE.

Diffuse scattering of *X*-rays by rock-salt. R. Q. Gregg and N. S. Gingrich (*Physical Rev.*, 1941, [ii], **59**, 619—621).—A "monochromatic Laue pattern" obtained with crystal-reflected Mo *Kα* radiation shows 40 diffuse spots. The positions, intensities, and half-widths at half-max. show good agreement with the predictions of Zachariasen (cf. A., 1940, I, 285). N. M. B.

***X*-Ray study of the structure of rectifying selenium films.** G. L. Clark and P. G. Roach (*Trans. Electrochem. Soc.*, 1941, **79**, *Preprint* 22, 269—279).—*X*-Ray investigations show that thin Se films, formed by spreading molten Se on Fe, Ni, or Ni-plated Fe strips, change from the amorphous to the hexagonal form on heating at 100—120°, but the resistance of these films is high and they show no rectifying properties. Heating at 200° leads to an increase in crystal size, with rapid decrease in resistance and development of rectifying action. Oxide and selenide films at the Se–metal interface do not produce a high resistance, and the rectifying action occurs at the Se–counter electrode interface. Impurities have only slight effects on resistance and rectifying properties. Polishing of the Se films leads to an increase in resistance and a very great increase in rectifying action. Treatment of amorphous films with $NHPh{\cdot}NH_2$ yields hexagonal cryst. films with preferred orientation, a factor detrimental to rectifier action; treatment with quinoline yields randomly oriented hexagonal films with good rectification. Films of monoclinic Se produced by the action of abs. EtOH on the amorphous film are unaffected by $NHPh{\cdot}NH_2$. J. W. S.

Structure of vitreous silica. S. S. Lu and Y. L. Chang (*Nature*, 1941, **147**, 642—643).—Debye–Scherrer photographs show the presence of two strong and six weak, diffuse bands, and three sharp lines which appear in certain cases. Positions and spacings are tabulated. The band corresponding with 7·1 A. could not be identified. Differences between the Debye–Scherrer and pin-hole transmission photographs have been traced to changes in structure produced by powdering the glass. In the transmission photographs the relative intensities of the two strong bands may change with different locations of the same specimen. This supports the view that large fluctuations occur in vitreous SiO_2. L. S. T.

Deformation and recrystallisation of copper and brass; hardness, microstructure, and texture changes. R. M. Brick and M. A. Williamson (*Amer. Inst. Min. Met. Eng.*, 1941, *Tech. Publ.* 1299, 8 pp.; *Met. Tech.*, 1941, **8**, No. 2).—Samples of polycryst. Cu and Cu–Zn alloys with 7—36% of Zn, having a grain size of 0·045 mm., and single crystals of 70—30 brass, were cold-rolled and subsequently annealed at various temp. The changes in hardness and texture are shown in curves and octahedral pole figures. The Cu samples when straight-rolled on 4-in. rolls hardened > when turned 90° at each pass, but no such difference was noted when Cu slabs were reduced in 18-in. rolls. In the straight-rolled Cu, (110) [112] and (112) [111] structures were present, as well as some material in the hitherto unreported (110) [110] orientation (the recrystallisation texture). The single crystals of brass showed markings along the octahedral planes after 20—40% reduction, and more confused structures after greater reductions. J. C. C.

Discontinuities of magnetostriction and magnetisation in nickel. C. W. Heaps (*Physical Rev.*, 1941, [ii], **59**, 585—587; cf. Bozorth, A., 1932, 987).—If the magnetic vector of a domain jumps through some angle other than 180°, a sudden redistribution of strains will be caused by the change of magnetostriction and a sound wave will travel out from the domain. Simultaneous records of the sounds and magnetisation jumps when the magnetisation of a Ni wire changes have been obtained; they indicate that reversals occur mainly when the magnetisation of the specimen is weak. N. M. B.

Polar vibrations of alkali halides. R. H. Lyddane, R. G. Sachs, and E. Teller (*Physical Rev.*, 1941, [ii], **59**, 673—676; cf. A., 1939, I, 63).—Mathematical. With the help of a special definition of the effective charge e^* of an ion, and without making any sp. assumptions about the detailed interactions between the ions, expressions are obtained for the frequency ω_l of the longitudinal, and the frequency ω_t of the transverse, vibration in terms of ϵ of the crystal, of ϵ_0 obtained by extrapolating n^2 of the crystal from high frequencies to zero frequency, and of e^*. The ratio of the two frequencies is found to be independent of e^* and given by $\omega_l/\omega_t = (\epsilon/\epsilon_0)^{\frac{1}{2}}$. N. M. B.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES.

Elastic modulus s_{13} of β-quartz. A. W. Lawson (*Physical Rev.*, 1941, [ii], **59**, 608—612).—The adiabatic Young's modulus of β-quartz along a direction at 45° to the optic axis was measured as a function of temp. The data, with those of Atanasoff (A., 1941, I, 105), give the val. $-0{\cdot}226 \times 10^{-12}$ sq. cm. per dyne at 600° for the adiabatic elastic modulus s_{13}. N. M. B.

Dependence of the direction of rectification in copper pyrites on voltage, temperature, and time of measurement. M. A. El-Sherbini and Y. L. Yousef (*Nature*, 1941, **147**, 543).—In Cu–Cu pyrites contacts the normal direction of easy flow is from the metal below 1 v. but is reversed between 20° and 200°. With p.d. of several v. the direction is from the crystal, but is reversed between 20° and −78°. Above a crit. temp. of ~500° K., or above a crit. p.d. of ~20 v. extrapolated at 0° K., the direction of rectification is always the same. L. S. T.

Acoustic velocity in Rochelle salt solutions. L. Sibaiya and R. L. Narasimhaiya (*Current Sci.*, 1941, **10**, 168—169).—Measurements of the velocity of sound (*V* m. per sec.) in aq. Na K tartrate solutions at three concns. give an extrapolated *V* val. of 2092 for the cryst. salt. Comparison with vals. calc. from elastic consts. (4484; cf. Mandell, A., 1929, 23) or light scattering (~3530; cf. Sibaiya, A., 1939, I, 132) shows that the linear extrapolation does not give the true *V* val. for the crystals (cf. Schaafs, A., 1937, I, 404). The extrapolated val. is, however, characteristic of the solute, and can be used to calculate *V* for a solution in a solvent for which *V* is known. A. J. E. W.

Magnetic susceptibility of aqueous iodic acid. Constitution of iodic acid. M. R. Nayar and N. K. Mundle (*Current Sci.*, 1941, **10**, 76).—0·01—1·0N. solutions of HIO_3 have been investigated; breaks in the χ–N. curve occur at 0·04N. and 0·08N. corresponding with breaks in the curves of other physical properties (cf. A., 1939, I, 198). W. R. A.

Thermal properties of pentane. P. R. Konz and G. G. Brown (*Ind. Eng. Chem.*, 1941, **33**, 617—623).—The Joule–Thomson effect *J* has been measured for n-C_5H_{12} vapour for a series of expansion steps from 3000 lb. per sq. in. at temp. up to ~800° F., the expanded vapour being led to a calorimetric condenser for enthalpy measurements. For the pressure step E = 626—14·7 lb. per sq. in. *J* is positive, falling continuously with rising final temp. θ_F. For E =

962—626 lb. per sq. in. J is negative up to $\theta_F = 250°$ F., and rises to a steep max. at $\theta_F = \sim 460°$ F. For the higher steps effects are similar but the max. gradually decreases and shifts to higher θ_F. The enthalpy is expressed by H (B.Th.U. per lb.) $= 0{\cdot}000287\theta^2 + 0{\cdot}315\theta + 158{\cdot}7$, θ being in °F. By differentiation an equation for the sp. heat is derived which agrees with known experimental vals. (cf. A.I., 1938, 21). Smoothed and extrapolated isenthalps are plotted on a pressure–temp. chart up to 5000 lb. per sq. in. and 900° F. A. R. PE.

Boiling points of *n*-alkyl nitriles. A. W. Ralston, W. M. Selby, and W. O. Pool (*Ind. Eng. Chem.*, 1941, **33**, 682—683).—B.p. of $Me{\cdot}[CH_2]_n{\cdot}CN$ ($n = 4$—16) are recorded for 11 pressures, including the following: $n = 4$, b.p. 44·7°/8, 164·8°/760 mm.; 5, b.p. 48·5°/4, 168·9°/760 mm.; 6, b.p. 41·1°/1, 206·8°/760 mm.; 7, b.p. 55·0°/1, 225·9°/760 mm.; 8, b.p. 69·6°/1, 244·1°/760 mm.; 9, b.p. 82·9°/1, 260·8°/760 mm.; 10, b.p. 95·8°/1, 276·7°/760 mm.; 11, b.p. 107·6°/1, 292·8°/760 mm.; 12, b.p. 118·9°/1, 306·9°/760 mm.; 13, b.p. 130·5°/1, 322·1°/760 mm.; 14, b.p. 142·3°/1, 334·3°/760 mm.; 15, b.p. 152·3°/1, 346·7°/760 mm.; 16, b.p. 161·3°/1, 357·4°/760 mm. B.p./760 mm. accord moderately with vals. calc. according to Kinney (A., 1939, I, 134) except for $C_{>13}$; discrepancies are at most partly due to decomp. The nitriles are prepared from RCO_2H by passage with NH_3 over Al_2O_3 at 400°, except for those with $n = 11$, 13, and 15, which are prepared from $Me{\cdot}[CH_2]_{n-1}{\cdot}I$ by KCN. R. S. C.

The Macleod constant and its dependence on physico-chemical factors. D. T. Lewis (*J. Physical Chem.*, 1940, **44**, 1007—1011).—Combination of the Macleod equation $\gamma = C(D - d)^4$ (where D and d are the densities of liquid and vapour, and C is a const.) with the law of rectilinear diameters leads to an equation $\gamma^{\frac{1}{4}} = \gamma_0^{\frac{1}{4}}[(1 + a) - aT/T_c](D - d)/[(1 + a)(D + d)]$, where T_c = crit. temp., γ_0 = the val. of γ at abs. zero, and a is ~ 1. If $a = 1$ and d is small, this becomes $\gamma^{\frac{1}{4}} = \gamma_0^{\frac{1}{4}}(2T_c - T)/2T_c$. These equations are compared with observation. F. J. G.

Temperature coefficient of density and refractive index for hydrocarbons in the liquid state. M. R. Lipkin and S. S. Kurtz, jun. (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 291—295).—Using the equation $d_4^\theta = d_4^{20} + \alpha(\theta - 20) + \beta(\theta - 20)^2$, where $\alpha = \Delta d/\Delta\theta$ of the liquid, density d at 20° and 1 atm., and β is the variation of $\Delta d/\Delta\theta$ with θ, a single curve of α against mol. wt. and a single curve of β against mol. wt. have been found applicable to all types of hydrocarbons with very few exceptions. From these curves the temp. coeff. of d of a liquid hydrocarbon at atm. pressure can be predicted from the mol. wt. to within $\pm 2 \times 10^{-5}$ g. per c.c. per °c. The definite exceptions are C_6H_6, C_6HEt_5, and C_6Pr_6; the curves are also applicable to hydrocarbon mixtures. Since $\Delta n = 0{\cdot}60\Delta d$, an accurate method of calculating density change also provides a satisfactory method for calculating change in n. J. D. R.

Nomographs for thermal conductivities of gases and vapours. D. S. Davis (*Ind. Eng. Chem.*, 1941, **33**, 675—678).—The gases and vapours are dealt with in three classes. (I) For CH_4, NH_3, CO_2, and N_2O the conductivity k_θ at $\theta°$ F. is given by $k_\theta = k_{32} + \alpha(\theta - 32)$, where α is a sp. const. (II) For NO, CO, O_2, N_2, H_2, and air, $k_\theta = k_{32}[(492 + C)/(\theta + 460 + C)][\theta + 460)/492]^{3/2}$, where C is Sutherland's const. (III) For C_2H_2, C_2H_4, C_6H_6, H_2O, and a no. of org. vapours the equation $k_\theta = m[(\theta + 600)/632]^n$, in which m and n are sp. consts., is proposed. Vals. of the consts. are tabulated and nomograms drawn whence k_θ can be found for the pure gases and vapours and for mixtures of H_2 with CO_2, N_2O, or N_2. A. R. PE.

Specific viscosity and mol. wt. of cellulose. O. P. Golova and J. J. Nikolaeva (*Compt. rend. Acad. Sci. U.R.S.S.*, 1940, **29**, 582—585).—The mol. wt. of cotton cellulose in a Cu–NH_3 solution has been determined by the sp. viscosity method in the presence of N_2 freed from traces of acids by several methods. In the purest N_2 employed, the mol. wt. is 720,000 and the degree of polymerisation 4300 glucose units; this is not considered as the limiting val., since traces of acids in small quantities of air present in the solution were not removed. The method has been applied to silk cellulose. A brief review of previous data is given. W. R. A.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

Volume change on mixing gases. A. E. Markham and K. A. Kobe (*J. Chem. Physics*, 1941, **9**, 438—439).—The vol. changes occurring on mixing pairs of the gases O_2, N_2, CO_2, and N_2O have been determined. With all pairs except N_2 and O_2 there is a small, but definite, increase in vol. on mixing, which is, however, $\ll$ the increase stated to occur by Fuchs (A., 1918, ii, 298). A. J. M.

Specific gravity of aqueous ethyl alcohol. Temperature corrections. C. R. Churchward (*J. Proc. Austral. Chem. Inst.*, 1941, **8**, 99—100).—Sp. gr. is determined by weighing at room temp. and correcting for temp. difference. Temp. corrections for the range 53—70° F., with sp. gr. to 0·962, and applicable to Thorpe's 60°/60° F. table, are tabulated. L. S. T.

Kinetic interpretation of osmosis. A. Niini (*Suomen Kem.*, 1940, **13, A**, 57—62).—The development of the kinetic theory of osmosis is outlined and discussed. C. R. H.

Investigation of silver amalgams by electron diffraction. Z. Pinsker and L. Tatarinova (*Acta Physicochim. U.R.S.S.*, 1941, **14**, 193—200).—Electron diffraction patterns of Ag and of Ag in successive stages of amalgamation have been studied. The results differ from those given by *X*-ray methods, and agree with those of other workers with the electron diffraction method in confirming the existence of compounds belonging to one cubic and two tetragonal phases. F. L. U.

Mechanism of precipitation from the solid solution of silver in aluminium. C. S. Barrett, A. H. Geisler, and R. F. Mehl (*Amer. Inst. Min. Met. Eng.*, 1941, *Tech. Publ.* 1275, 15 pp.; *Met. Tech.*, **8**, No. 2).—Changes in the lattice during the ageing of a 20·2 wt.-% Ag–Al alloy were studied. During pptn., the alloy forms plate-like Guinier–Preston aggregates on the (111) plane, and also a transitional close-packed hexagonal lattice which is deposited on the (111) phase parallel to the equilibrium lattice. It is concluded that the various stages in pptn. are merely successive steps in a single process of lattice alteration. J. C. C.

Iron–phosphorus alloys.—See B., 1941, I, 294.

Rate of diffusion of manganese in gamma iron in low-carbon and high-carbon manganese steels. C. Wells and R. F. Mehl (*Amer. Inst. Min. Met. Eng.*, 1941, *Tech. Publ.* 1282, 13 pp.; *Met. Tech.*, **8**, No. 2).—The rate of diffusion, D, of Mn across the welded interface of two bars of different composition heated in A at 1000—1450° was determined from the results of chemical analysis of layers subsequently machined from the specimens. D for Mn is only $\sim 1/50{,}000$ of that for C; it increases 125% as the Mn content is varied from 0 to 60%, it increases 350% as C content is varied from 0 to 1·5%, and it appears to be independent of grain size. The results are expressed in the form of empirical equations. J. C. C.

Copper–nickel–zirconium–aluminium alloys.—See B., 1941, I, 297.

Solubility of methane in *n*-hexane. E. P. Schoch, A. E. Hoffmann, and F. D. Mayfield (*Ind. Eng. Chem.*, 1941, **33**, 688—691).—Sp. vols. of CH_4–n-C_6H_{14} mixtures have been determined at 100·27°, 160°, and 220° F. under pressures up to 6000 lb. per sq. in. and are compared with data of previous workers (B., 1936, 1076; A., 1938, I, 622). Thence sp. vols. and pressures at the bubble point are plotted. The solubility of CH_4 decreases in the series C_6H_{14} > *cyclo*hexane > C_6H_6 (cf. A., 1940, I, 319; 1941, I, 9). A. R. PE.

Solubility of morphine in water. Determination of coefficients of solubility. E. Sellés (*Anal. Fis. Quím.*, 1941, **37**, 119—122).—The apparatus described permits the filtration of a solute agitated in contact with its saturated solution and maintained at a regulated temp. The solubility of morphine in H_2O is recorded at regular intervals and varies continuously with temp. from 0·26 at 13° to 1·47 g. per l. at 90°. F. R. G.

Furfural[dehyde] as solvent. F. Trimble (*Ind. Eng. Chem.*, 1941, **33**, 660—662).—In view of the use of furfuraldehyde as a selective solvent, the solubilities in a technically pure product of 20 org. acids, 9 other org. compounds, and 80 salts and oxides are tabulated. Inorg. salts are usually

insol. at room temp., but $ZnCl_2$, $Ca(NO_3)_2,4H_2O$, $FeCl_3,6H_2O$, and $Ba(OH)_2,8H_2O$ are sol. Saturated aliphatic hydrocarbons show limited solubility, but aromatic hydrocarbons are completely miscible. S. M.

Nature of the adsorption of fatty acids from organic solvents by inorganic lead compounds. A. Knoll and D. L. Baker (*Amer. Inst. Min. Met. Eng.*, 1941, *Tech. Publ.* 1314, 4 pp.).—Powdered galena removes fatty acids from solutions of these acids in non-aq. solvents. The particles produced are not wetted by $PhNO_2$ and are highly H_2O-repellent. The adsorption of fatty acid is attributed to reaction of the acid with the Pb salts in the surface forming films of Pb soaps. Similar films are formed on cerussite but not on anglesite. J. W. S.

Permeability in monolayers. F. Sebba and E. K. Rideal (*Trans. Faraday Soc.*, 1941, **37**, 273—278).—The apparatus previously described (A., 1940, I, 160) was used to determine the permeability (P) of various monolayers to H_2O vapour. Protein and tanned protein are freely permeable. P of cetyl alcohol is approx. that of its complex with Na cetyl sulphate. P of a mixed film of eicosoic acid and docosyl alcohol is > that of a film of either component. Stearic acid is more permeable than its esters. The retardation of the evaporation of NH_3 from aq. NH_3 is not parallel with that of H_2O. The effect of eicosoic acid films in retarding the evaporation of 5% aq. EtOH appears to be selective, and differences are caused by the nature of the solvent used to spread the film; these differences decrease in course of time and are presumably due to the imprisonment of traces of solvent. F. L. U.

Insect cuticle as an asymmetrical membrane.—See A., 1941, III, 468.

Size distribution of particulate materials.—See B., 1941, I, 251.

Suspensions of solids in mixed liquids. E. W. J. Mardles (*Trans. Faraday Soc.*, 1941, **37**, 321—327; cf. A., 1941, I, 40).—Sediment vols. of kaolin, mica, SiO_2, and Al powder in binary and ternary liquid mixtures have been measured as a function of composition. Addition of a small amount of adsorbable sol. substances (oleic acid, fish glue, cellulose acetate) decreases the sediment vol. Viscosity measurements indicate a general parallelism between η and sediment vol., high vals. of which are associated with flocculation of the particles. The rate of settling of various powders was also examined; the behaviour is largely governed by the degree of flocculation and by the shape of the particles. F. L. U.

Importance of dialysis in the study of colloids. VII. Colloidal zinc ferrocyanide. V. C. Vora, P. M. Barve, and B. N. Desai (*Proc. Indian Acad. Sci.*, 1941, **13, A**, 100—107).—With the progress of dialysis of colloidal $Zn_2Fe(CN)_6$ the cataphoretic speed first increases and then decreases while the stability and conductivity decrease continuously. In the case of sols dialysed for periods shorter than the max. in the cataphoretic speed–dialysis curve the speed first increases and then decreases on dilution, whilst for sols dialysed for longer periods the speed decreases continuously. Stability and conductivity decrease continuously on dilution in all cases. With sols dialysed for a short time the cataphoretic speed first increases and then decreases on adding small increasing amounts of KCl, K_2SO_4, $K_4Fe(CN)_6$, $MgCl_2$, and $MgSO_4$; with sols dialysed for longer times the speed decreases continuously with all the electrolytes except $K_4Fe(CN)_6$, with which it first increases and then decreases. The idea of crit. potential is not supported. Cataphoretic speed, stability, and conductivity decrease continuously when sols, whatever the period of dialysis, are aged or exposed to sunlight. H. W.

Viscosity of cellulose and its nitrate in dilute solution. S. M. Neale and R. Waite (*Trans. Faraday Soc.*, 1941, **37**, 261—271).—Determination of the η of solutions of the same sample of cotton cellulose in cuprammonium hydroxide solvents of different compositions, at concns. up to 0·6 g. per 100 c.c., lead to limiting vals. ($c = 0$) of $\eta_{sp.}$ that vary with the solvent. Neither log η nor $\eta_{sp.}$ is $\propto$ the concn. In all but the most dil. solutions η varies with the rate of shear. Similar results are obtained when the same sample of cotton is nitrated and the nitrate dissolved in various org. solvents. The degree of polymerisation, both for the cellulose and for its nitrate, corresponds with 2000—3000 glucose units when calc. by the method of Kraemer and Lansing (cf. A., 1935, 688). F. L. U.

Surface characteristics of cotton fibres as indicated by electrophoresis.—See B., 1941, II, 216.

Base-combining capacity of cotton.—See B., 1941, II, 216.

New views and results on coagulating effect of electrolytes on hydrophobic colloids. Wo. Ostwald (*J. Hung. Chem. Soc.*, 1941, **2**, No. 1, 1—9).—A lecture containing a historical review of coagulation theories and an account of the author's theory. E. A.

Cataphoretic speed of sol particles as dependent on the redox potential of the liquid medium. J. C. Ghosh and N. G. Basak (*J. Indian Chem. Soc.*, 1940, **17**, 721—729).—The mobilities (Λ) of colloidal Au and Pt particles in very dil. aq. solutions of redox dyes have been determined, the electron activity being varied by reducing the dyes to different extents with H_2 and Pt-black or with N_2H_4,H_2O, and the p_H being varied by the addition of aq. NH_3 or AcOH. The results indicate that the change in Λ and hence in the electrokinetic potential is probably due not to any sp. ionic adsorption but to more general factors, particularly the electron activity of the medium responsible for the redox potential of the system. J. W. S.

VI.—KINETIC THEORY. THERMODYNAMICS.

Ethane–ethylene–hydrogen equilibrium. E. A. Guggenheim (*Trans. Faraday Soc.*, 1941, **37**, 271—273).—Revision of the calculations recently published (A., 1941, I, 113) results in a decrease of 4% in the calc. vals. of K_p in the range 673—973° K. F. L. U.

Colour phenomena associated with quinquevalent molybdenum solutions. II. Effect of various electrolytes. C. F. Hiskey and V. W. Meloche (*J. Amer. Chem. Soc.*, 1941, **63**, 964—969).—The influence of $MgCl_2$, LiCl, NaCl, and KCl in 2M-HCl; LiCl in 0·2M-HCl; HBr; $MgBr_2$ in 2M-HBr; and H_2SO_4 (>8·0M.) in 3·5, 2·5, 1·5, 1·0, 0·5, and 0·1M-HCl on the transition of Mo^V from the colourless to amber forms (A., 1940, I, 369) has been investigated. The results depend on the dehydrating effect produced by [H⁺] and on the tendency of an added solvent to unite with H_2O of the system by means of dipole–dipole interactions. W. R. A.

Electric polarisation of carboxylic acids in dilute solutions of non-polar solvents. I. Relation of electric polarisation to association of carboxylic acids in hydrocarbon solvents. H. A. Pohl, M. E. Hobbs, and P. M. Gross. **II. Polarisation of heavy acetic acid and of the three fluorobenzoic acids in benzene and the anomalous polarisation of the dimeride.** A. A. Maryott, M. E. Hobbs, and P. M. Gross (*J. Chem. Physics*, 1941, **9**, 408—414, 415—418).—I. The electric polarisations of very dil. solutions of AcOH, HCO_2H, $EtCO_2H$, $PrCO_2H$, $Bu^{\gamma}CO_2H$, $CH_2Cl{\cdot}CO_2H$ (I), and BzOH in C_6H_6 and C_7H_{16} have been determined in order to study the association and polar character of these acids. The graph of mol. polarisation against mol. fraction shows a decided curvature, which can be explained by supposing that in dil. solution there exists a mixture of highly polar single mols. and slightly polar or non-polar double mols. With increase of concn. of acid, association of single to double mols. occurs, producing a less polar mixture. The polarisations of the single mols. [except (I)] are fairly const., in agreement with the fact that the moment is due to the CO_2H group. There is a rather large and substantially const. val. of the polarisation, $P_{D(A+O)}$, for all the dimeric mols. examined [except (I)]. The origin of this is considered to be an at. type of polarisation. AcOH and HCO_2H have considerably lower dissociation consts. in C_7H_{16} than in C_6H_6, indicating that the unsaturated and highly anisotropic C_6H_6 mol. is a much better dissociating solvent.

II. The electric polarisation of AcOD, *o*-, *m*-, and *p*-$C_6H_4F{\cdot}CO_2H$ has been determined in C_6H_6 solution, at concns. of 10^{-5} to 10^{-2} mol. fraction of solute. The high polarisation of dimeric mols. is discussed. It can only be satisfactorily explained as an at. polarisation term. There is very little difference in the P_S and P_D of heavy and light AcOH. The equilibrium const. of *o*-$C_6H_4F{\cdot}CO_2H$ ($4{\cdot}7 \times 10^{-4}$) is considerably > that of the other isomerides ($\sim 0{\cdot}6 \times 10^{-4}$). This is probably due to a stabilisation of the mol. through H bond formation with the adjacent F atom. A. J. M.

Formation of ions from compounds with conjugated double bonds: hydrocarbon salts.—See A., 1941, II, 190.

Dissociation constants of the methylammonium ions and the basic strengths of the methylamines in water. D. H. Everett and W. F. K. Wynne-Jones (*Proc. Roy. Soc.*, 1941, **A, 177**, 499—516).—The dissociation consts. of the three substituted methylammonium ions were determined in aq. solution at 10° intervals from 0° to 50°. Vals. of the free energy, heat and entropy of dissociation are tabulated. The heat capacity changes are discussed and it is shown that they cannot be interpreted by simple electrostatic theory. The anomalous order of the basic strengths of the amines probably disappears at low temp. G. D. P.

Theory of acid strength. Temperature effect. J. L. Magee, T. Ri, and H. Eyring (*J. Chem. Physics*, 1941, **9**, 419—427).—The dissociation consts. (K) of certain acids and bases pass through a max. in the neighbourhood of room temp. Thermodynamic treatment leads to the following equation connecting K, $K_{max.}$ the temp. θ at which K is a max., and the temp. T: $\log K - \log K_{max.} = p(T - \theta^2) + q(T - \theta)^3 + \ldots$ The consts. p and q are evaluated, and for acids in aq. solution they are almost completely determined by the properties of H_2O, particularly the temp. variation of the dielectric const. The mechanism of dissociation is discussed. The dissociation of H_2O can be represented by $(m + n + 2)H_2O \rightleftharpoons H_3O^+(mH_2O) + OH^-(nH_2O)$, the m mols. of H_2O being "frozen" to the H_3O^+ and n to OH^-; $m + n + 2 \sim 16$. This is in agreement with the work of Harned *et al.* on H_2O–dioxan mixtures (A., 1939, I, 565). A. J. M.

Activity coefficient of hydriodic acid at 25° from isopiestic vapour-pressure measurements. H. S. Harned and R. A. Robinson (*Trans. Faraday Soc.*, 1941, **37**, 302—307).—Data for the osmotic and activity coeffs. of HI over the range 0·05—3·0M. are tabulated. The log γ–$\sqrt{m}$ curve is higher than any yet obtained for 1—1 electrolytes. The results are fitted to two extended forms of the Debye–Hückel equation and, using published e.m.f. data, the normal potential E° of the Ag|AgI electrode is calc. to be 0·1517 v. The free energy changes of some H–I reactions are discussed and $E^\circ = 0{\cdot}5352$ v. is computed for the $I_2|I'$ electrode. F. L. U.

Solutions of long-chain compounds. M. L. Huggins (*J. Chem. Physics*, 1941, **9**, 440).—The method of Fowler *et al.* (A., 1937, I, 513) for deriving statistically equations for the activities of the constituents of a dil. binary solution, in which the solute mols. are elongated and occupy twice the vol. of a single solvent mol. and there is no heat of mixing, has been extended to a dil. solutions of long-chain mols. each made up of randomly oriented "sub-mols." similar in nature and size to one of the solvent mols. The application of the equation to osmotic pressure is given. A. J. M.

Equilibrium conditions in two-phase multi-component systems. I. A. Storonkin (*Acta Physicochim. U.R.S.S.*, 1940, **13**, 505—530).—The general conditions for equilibrium in a two-phase system of n components are expressed in differential equations, and certain known regularities are deduced as special cases. F. J. G.

Liquid–vapour equilibrium relations in binary systems. *n*-Butane–*n*-heptane system. W. B. Kay (*Ind. Eng. Chem.*, 1941, **33**, 590—594; cf. A., 1938, I, 241).—Pressure–temp. curves up to the crit. points and d of liquid and vapour have been determined for mixtures of n-C_4H_{10} and n-C_7H_{16}. The max. crit. pressure is 596 lb. per sq. in. at 77 mol.-% of C_4H_{10}. With rising temp. and pressure the vapour/liquid concn. ratios of C_4H_{10} dissolved in C_7H_{16}, and of C_7H_{16} dissolved in C_4H_{10}, deviate from those calc. from the fugacities until at the crit. point the ideal solution laws are quite inapplicable. A. R. Pe.

Energy of formation and solubility of ferrous sulphide. W. D. Treadwell and O. Gübeli (*Helv. Chim. Acta*, 1941, **24**, 137—148).—The equilibrium $FeS + H_2 \rightleftharpoons Fe + H_2S$ has been studied at 250—700° by the circulation method. The heat of reaction is calc. to be 18,050 g.-cal. per g.-mol., the difference between this val. and that calc. from literature vals. of the heat of formation of FeS (~18,490 g.-cal. per g.-mol.) being attributed to the heat of transition of FeS at 298°. From the equilibrium data and published val. of the Fe electrode potential, the solubility const. $[Fe^{\cdot\cdot}][H_2S]/[H^\cdot]_z$ of the thermally produced FeS is calc. to be $1{\cdot}35 \times 10^2$ and $0{\cdot}95 \times 10^2$ at 25° for the high- and low-temp. forms, respectively, whereas the observed val. for pptd. FeS is $2{\cdot}8 \times 10^3$. This high val. is attributed to diminution of the lattice energy of the pptd. material through inclusion of foreign ions and H_2O of hydration. The val. of the entropy changes of the reaction calc. from these results can be reconciled with the val. calc. from the entropy vals. of the reactants if Cross' val. of the entropy of H_2S (A., 1935, 569) is changed from 49·15 to 48·25 entropy units. J. W. S.

M.p. of binary mixtures of oleic, linoleic, and linolenic acids. H. W. Stewart and D. H. Wheeler (*Oil and Soap*, 1941, **18**, 69—71).—The m.p. (by capillary-tube method) curve of mixtures of pure oleic acid (**I**) (prepared from Me oleate; cf. Wheeler and Riemenschneider, B., 1940, 222) and linoleic acid (**II**) affords no evidence of compound formation, but shows eutectics at 75·2 mol.-% of (**II**) at −10·0° for the α- and 76·3 mol.-% for the β-form of (**I**) at −9·8°. Similarly, the graphs for the system (**I**)–linolenic acid (**III**) show eutectics at 82·7 mol.-% of (**III**) at −15·7° for α- and 85·5 mol.-% at −15·1° for β-oleic acid. The appearance of the β-form of (**I**) and the consequent double m.p. is observed on the (**I**) side of the eutectics only (cf. Smith, A., 1939, II, 356) in mixtures containing >50% of (**II**) or (**III**). Mixtures of (**II**) and (**III**) give m.p. between those of the pure acids, the curve showing neither eutectic nor evidence of compound formation. E. L.

Intermolecular compounds. H. M. Haendler and L. W. Rising (*J. Amer. Pharm. Assoc.*, 1941, **30**, 105—107).—Tabulated data for "thaw point" and m.p. of various mixtures of NHPhAc–antipyrine (**I**), –mandelic acid (**II**), –β-$C_{10}H_7$·OH (**III**), –phenacetin (**IV**), –pyramidone, –sulphonal (**V**), and –trional, (**IV**)–(**I**), –(**II**), and –(**III**), and (**II**)–(**III**) and –(**V**) do not indicate the formation of a compound in any of these systems. F. O. H.

Alumina floc. Composition of floc formed at p_H values below 5·5. H. E. Weiser, W. O. Milligan, and W. R. Purcell (*Ind. Eng. Chem.*, 1941, **33**, 669—672).—*X*-Ray radiograms of Al_2O_3 gels formed at p_H <5·5 by adding NaOH to $Al_2(SO_4)_3$ solutions show the presence of a cryst. phase differing from that of γ-Al_2O_3,H_2O (**I**) which is formed at p_H >5·5. The aged ppt. gives a pattern distinct from that for any recognised form of hydrated or anhyd. Al_2O_3; the dehydration isobar and analysis indicate the composition $Al_2O_3,SO_3,1{\cdot}5H_2O$. No other basic sulphate was indicated. Gels made from $Al(NO_3)_3$ and $AlCl_3$ at p_H 4 had composition (**I**); no basic nitrates or chlorides were formed. Breaks in the potentiometric titration curves of the Al salts with NaOH do not establish the presence of basic salts. S. M.

Ammonia-soda process under high pressures of carbon dioxide. Identification of solid phases. Phase diagrams.—See B., 1941, I, 282.

Equilibria of liquid iron and slags of the system CaO–MgO–FeO–SiO$_2$. K. L. Fetters and J. Chapman (*Amer. Inst. Min. Met. Eng.*, 1941, *Tech. Publ.* 1316, 13 pp.; *Met. Tech.*, 1941, **8**, No. 2).—Slag mixtures consisting of CaO, MgO, SiO_2, FeO, and Fe_2O_3 were maintained at a series of temp. in contact with pure Fe in MgO crucibles under N_2 until equilibrium was reached (for >30 min.), after which samples of slag and metal were taken for chemical analysis. The analytical results are tabulated. The [O] of Fe in equilibrium with slag is a function of the temp. and both [O] and [S] vary with slag composition. The [O] at 1600°, the distribution ratios between slag and metal for O and S at 1600°, the activity of the FeO in the slag, and the % remaining as Fe_2O_3 at 1600° are shown in ternary diagrams [the composition of the slag being expressed for simplicity as (CaO + MgO)–FeO–SiO_2]. The solubility of MgO in CaO–FeO–SiO_2 slags is also shown. Preliminary observations indicate that stable orthosilicates and monoferrites exist in the liquid slags. J. C. C.

Vapour pressure and vapour composition in liquid mixtures. V. Kireev (*Acta Physicochim. U.R.S.S.*, 1940, **13**, 552—564).—The generalisation (cf. following abstract) that in a given mixture S_E and S_{iE} are respectively $\propto H_M$ and H_{iM} is used in the derivation of relations between v.p., vapour composition, and heat of mixing, for binary mixtures. The conditions for azeotropy are discussed. F. J. G.

Change of entropy and of free energy in the formation of liquid mixtures. V. Kireev (*Acta Physicochim. U.R.S.S.*,

1940, **13**, 531—551).—Recorded v.p. and calorimetric data have been used in a computation of the entropies (S_M) and partial mol. entropies (S_{iM}) of mixing for a no. of binary liquid mixtures. For two systems, C_6H_6–CCl_4 and CS_2–Et_2O, the deviations (S_E and S_{iE}) of S_M and S_{iM} from the ideal vals. are very small, but in general S_E and S_{iE}, though relatively small, are too great to be neglected, since TS_E and TS_{iE} are comparable with H_M and H_{iM}, the total and partial mol. heats of mixing. In many systems S_E and S_{iE} are approx. $\propto H_M$ and H_{iM} respectively. The rule that an evolution of heat on mixing accompanies a negative departure from linearity of the v.p–composition curve is not generally valid.

F. J. G.

Thermodynamic properties of phosphorus, phosphine, and some phosphorus halides. D. P. Stevenson and D. M. Yost (*J. Chem. Physics*, 1941, **9**, 403—408).—The free energies, entropies, and heat contents of P and a no. of P compounds are calc. from equilibrium, mol., and thermal data. For P vapour, the equilibrium const. of the dissociation $P_2 \rightleftharpoons 2P$ is calc. from equilibrium and mol. data, and also from spectroscopic data, the latter being regarded as the more satisfactory. Dissociation of P_2 is very slight, even at 1200°. The entropy of white P is calc. The equilibrium consts. and ΔH_0 of the reactions $P_4 + 6H_2 \rightleftharpoons 4PH_3$ and $PCl_3 + Cl_2 \rightleftharpoons PCl_5$ have been calc. The free energies and heat contents of P, P_2, P_4, PH_3, PF_3, PCl_3, PBr_3, PCl_5, $POCl_3$, and $PSCl_3$ at temp. from 298° to 1500° K. are given, and are intended to replace the vals. given by Anderson *et al.* (A., 1936, 1340). A. J. M.

Free energies of formation of gaseous hydrocarbons and related substances. C. M. Thacker, H. O. Folkins, and E. L. Miller (*Ind. Eng. Chem.*, 1941, **33**, 584—590).—Equations are tabulated expressing as a function of temp. (*a*) the sp. heats in the gaseous state of the paraffins up to n-$C_{10}H_{22}$, the Δ^α-olefines up to $C_{10}H_{20}$, H_2, O_2, CO, CO_2, and H_2O, and of graphite, and (*b*) the free energies of formation of the above substances, of 29 branched-chain paraffins, of 23 other C_2H_4 derivatives, and of CS_2, H_2S, NH_3, SO_2, and SO_3. Standard free energies of formation calc. from these data at 100° intervals from 300° to 1200° K. are tabulated. The increase per CH_2 group of sp. heat in the paraffin series from C_3H_8 is expressed by $\Delta C_p = 0{\cdot}51 + 0{\cdot}13T$, T being abs. temp. Sp. heats of the Δ^α-olefines were derived from those of the corresponding paraffins by extrapolating from the experimental ratios for the C_2, C_3, and C_4 members. The data for the branched chains are less accurate than the rest but with this qualification the tables can be used to predict changes of equilibrium with temp. (cf. Thomas *et al.*, A., 1938, I, 32).

A. R. Pe.

VII.—ELECTROCHEMISTRY.

Hydrogen overvoltage at high current densities. III. Influence of oxygen. A. Hickling and F. W. Salt (*Trans. Faraday Soc.*, 1941, **37**, 319—321).—Measurements of H overvoltage at amalgamated Cu electrodes show it to be unaffected by O_2 at c.d. $\nless 10$ times the limiting current for O_2 diffusion to the cathode, and to be completely eliminated below a crit. c.d. which is higher for stirred and lower for unstirred solutions. For unstirred aq. solutions in air O_2 is without appreciable influence at c.d. $\nless 1$ ma. per sq. cm., provided time is allowed for the diffusion layer to be built up.

F. L. U.

Decay of hydrogen overpotential at a mercury surface. S. C. Ganguli (*J. Indian Chem. Soc.*, 1940, **17**, 691—698).—0·1N-Na_2SO_4 containing different concns. of maleic or fumaric acid has been electrolysed for various periods of time, and the decay in the potential of the Hg cathode after switching off the current studied. When the potential relative to a 0·1N-Hg_2Cl_2 electrode is 1·35—1·5 v. immediately after interrupting the current, the potential rises during the first few min. and then decays exponentially, whereas when the initial potential is outside these limits it begins to decay immediately, as in the absence of reducible material. The observations are in accord with the view that both the transference of an electron from the electrode to the hydrated H^+ ion and the combination of H atoms adsorbed on the electrode are slow processes with comparable velocities. J. W. S.

Polarographic study of aliphatic nitro-compounds.—See A. 1941, II, 209.

VIII.—REACTIONS.

Thermal reaction between hydrogen and oxygen. III. Temperature coefficient of the steady thermal reaction. O. Oldenberg and H. S. Sommers, jun. (*J. Chem. Physics*, 1941, **9**, 432—438).—The thermal combination of H_2 and O_2 has been investigated in various vessels (quartz, Pyrex, and Pyrex covered with KCl). The reaction follows the Arrhenius law over the temp. range considered (~490—570°). Addition of He had no effect on the rate of combination. It is concluded that in this temp. range the chains are not branched. A. J. M.

Thermal explosion of the $2H_2 + O_2$ mixture. D. Frank-Kamenetzki (*Acta Physicochim. U.R.S.S.*, 1940, **13**, 730—731).—The location of the third explosion limit of the $2H_2 + O_2$ mixture, reported by Oldenberg and Sommers (A., 1939, I, 325), was predicted by the author on theoretical grounds (cf. A., 1940, I, 259). The approx. agreement between theory and experiment indicates the thermal nature of this third limit. F. L. U.

Limits of inflammability of butadiene in air. G. W. Jones and R. E. Kennedy (*U.S. Bur. Mines*, 1941, *Rept. Invest.* 3565, 4 pp.).—Tests made in a tube of sufficient diameter to minimise the cooling effect of the wall and long enough to ascertain whether flame propagation continues after the heating effect due to the ignition source is dissipated indicate that the lower and upper limits of inflammability of $(CH_2{:}CH)_2$ in air at room temp. and pressure are 2·0 and 11·5 vol.-%, respectively. J. W. S.

Kinetics of polymerisation of vinyl acetate in presence of benzoyl peroxide in benzene solution. S. Kamenskaja and S. Medvedev (*Acta Physicochim. U.R.S.S.*, 1940, **13**, 565—586).—The polymerisation of $CH_2{:}CH{\cdot}OAc$ (**I**) in C_6H_6 solution at 50—85° in presence of Bz_2O_2 (**II**) has been studied. Under these conditions the thermal reaction is negligible, and the process is completely homogeneous. (**II**) in C_6H_6 solution undergoes a unimol. decomp. with $E = 29{\cdot}6$ kg.-cal. During the polymerisation of (**I**) the disappearance of (**II**) is still unimol. but is more rapid and does not follow the Arrhenius equation. The kinetics of the polymerisation accord with a chain mechanism in which a complex of (**I**) and (**II**) reacts with (**I**) to give free radicals; $E = 25{\cdot}5$ kg.-cal. The mean chain length and the mean degree of polymerisation are not symbatic. This is accounted for by "chain transfer": a polymeride radical may take a H atom from some mol. species (reactant or solvent), so stabilising itself, while the resultant free radical starts another chain. F. J. G.

Kinetics of action of trypsin on synthetic substrates.—See A., 1941, III, 534.

Kinetics of proteinase action. Application to specificity problems.—See A., 1941, II, 534.

Dependence of the laws of size distribution of crystals on kinetics of crystallisation. II. Laws of crystallisation with decreasing concentration in the homogeneous phase. O. M. Todes (*Acta Physicochim. U.R.S.S.*, 1940, **13**, 617—638; cf. A., 1941, I, 81).—Mathematical. Expressions are derived for the rate of crystallisation, max. size, and size distribution for the case where the probability of the occurrence of crystallisation centres, as well as the rate of linear growth, depends on the concn. of the homogeneous crystallising phase. The combination of these conditions with the initial presence of crystallisation centres is also treated. F. L. U.

Sensitised explosions. V. Hydrogen–oxygen reaction sensitised by nitrogen peroxide. VI. Hydrogen–oxygen reaction sensitised by nitrosyl chloride. VII. A chain–thermal theory of the reaction between hydrogen and oxygen sensitised by nitrogen peroxide or nitrosyl chloride. F. S. Dainton and R. G. W. Norrish (*Proc. Roy. Soc.*, 1941, **A, 177**, 393—410, 411—420, 421—447; cf. A., 1939, I, 528).—V. The effect of pressure and temp. of reactants, of inert gases, of vessel diameter, and of surface condition on the induction periods and explosion boundary of $2H_2O + O_2$ mixtures containing NO_2 has been determined in the range 350—410°. At any given pressure of the reactants there are two concns. of NO_2 which mark the upper and lower limits of the explosion region; at a given concn. of sensitiser there are two pressures of reactants enclosing the ignition region. The induction periods of mixtures of const. $[NO_2]$ decrease rapidly with increase of

pressure. All foreign gases lengthen the induction periods and eventually quench the ignition of an explosive mixture. The efficiency of gases in lengthening the induction period is $CO_2 > N_2 > A = He$; the efficiency in quenching ignition is $CO_2 > He > N_2 > A$. The induction period at the upper limit is > at the lower limit. At const. total pressure the upper limit P_u varies with temp. according to the equation $\log P_u = -E/RT + \text{const.}$; the upper limit decreases and the lower increases as the reciprocal of the square of the diameter of the reaction vessel.

VI. The induction periods and limits depend on pressure and temp. in a very similar way to those in the system H_2–O_2–NO_2 (cf. Part V, above). Inert gases quench the ignition but shorten the induction periods.

VII. Both the above reactions are chain processes for which the net branching factor ϕ is inversely $\propto$ to the induction period. Ignition occurs only when ϕ attains a val. determined by the sum of two quantities, one $\propto$ thermal capacity and the other $\propto$ thermal conductivity. Ignition is visualised as occurring only when the initial reaction rate in a favourable vol. element is large enough to ensure a crit. temp. T_c being reached in a crit. time t_c. The theory accounts satisfactorily for the experimental data. G. D. P.

Autocatalytic character of the decomposition of the hypochlorite ion. J. M. González Barredo (*Anal. Fís. Quím.*, 1941, **37**, 123—157).—Application of the author's method (A., 1936, 1074) to a kinetic study of the decomp. of NaOCl solutions at const. p_H shows that Cl′ autocatalyses the reaction to an extent which increases with the concn. of Cl′. The catalytic effect of NO_3' is $\ll$ of Cl′. F. R. G.

Theory of the formation of catalytically active ensembles on surfaces. IV. Application of the theory to catalyst-poisoning. N. I. Kobosev (*Acta Physicochim. U.R.S.S.*, 1940, **13**, 469—504).—The phenomena of poisoning are discussed in the light of the theory (A., 1939, I, 271) that catalytically-active groupings of atoms are distributed statistically among migration regions which are thermodynamically isolated from one another. It is shown that the probability (β) that a mol. of poison entering a region containing an active group shall become adsorbed on that group, and so deactivate it, will in general be $\sim$1. For $\beta = 1$, the residual activity will be $A = A_0 e^{-g/Z_0}$, where g is the total quantity of adsorbed poison and Z_0 the no. of individual migration regions. For $\beta < 1$, a more complicated expression is obtained, indicating a linear dependence of A on g/Z_0 in the early stages of poisoning. It is deduced that the course of the poisoning will be independent of the nature of the reaction and of the poison, and the relative activity A/A_0 independent of temp., in agreement with observation. Results taken from literature are discussed, and vals. of Z_0, and hence of r_{Z_0}, the activity per migration region, are obtained for the various catalysts, and compared. The individual migration regions are found to be very small ($\sim$10 atoms); the effect of a carrier is usually to increase Z_0, and this both increases the activity and diminishes the susceptibility to poisoning; in some cases carriers also increase r_{Z_0}. F. J. G.

Correlation between adsorption of hydrogen and activity of catalysts containing copper oxides. B. R. Stanerson (*Iowa State Coll. J. Sci.*, 1940, **15**, 104—106).—Cu_2O, prepared by reducing $Cu(NO_3)_2$ with glucose, adsorbed H_2 so that equilibrium was reached in $\sim$2 hr. at 57° and more rapidly at higher temp. Only $\sim$0·2 of the H_2 adsorbed was freed when the pressure was reduced from 52·27 to 2·81 cm. of H_2O. Promoters of H_2 adsorption were active in the following descending order of efficiency: BaO, CaO + V_2O_4, CaO, SrO, MgO. There is an approx. parallelism between the adsorptive power of the catalysts and their ability to reduce furfuraldehyde at 222° and 600 lb. pressure. J. L. D.

Properties of activated sugar charcoal coated with various organic substances. III. Catalytic decomposition of hydrogen peroxide. H. K. Acharya (*J. Indian Chem. Soc.*, 1941, **18**, 15—18; cf. A., 1937, I, 457).—Coats of palmitic acid and α-$C_{10}H_7$·NH_2 on activated sugar-C (0·01 g. per g. of C) increase the catalytic decomp. of H_2O_2 by the C. In both cases decomp. follows a unimol. reaction rate and is independent of p_H, as has been found for uncoated C. C. R. H.

Formation of propylene by [catalytic] dehydrogenation of propane.—See B., 1941, II, 209.

[Catalytic] preparation of ethylbenzene from naphthalene.—See B., 1941, II, 209.

Ruthenium catalysts for synthesis of hydrocarbons of high mol. wt.—See B., 1941, I, 274.

[Catalytic] synthesis of benzine from carbon monoxide and hydrogen.—See B., 1941, I, 272.

[Catalytic] hydrogenation of anthracene and carbazole.—See B., 1941, II, 210.

[Catalytic] dehydration of $\alpha\gamma$-butylene glycol.—See B., 1941, II, 209.

Chemical action of electrical discharges. XXI. Variation of the yield of hydrogen cyanide produced by means of the high-frequency arc with the molecular size of the hydrocarbon. E. Briner and H. Hoefer (*Helv. Chim. Acta*, 1941, **24**, 188—190; cf. A., 1941, I, 53).—The yield of HCN obtained on passage of a mixture of hydrocarbon vapour and N_2 through a high-frequency arc varies only slightly with the mol. wt. of the hydrocarbon between C_8H_{18} and $C_{12}H_{26}$. A slight tendency for it to decrease beyond $C_{10}H_{22}$ is attributable to the necessity of diminishing the hydrocarbon concn. to reduce carbonisation. It is inferred that petroleum fractions covering a fairly wide b.p. range (100—200°) can be used to obtain high yields of HCN in the high-frequency arc. J. W. S.

Chemical syntheses by means of electric discharges and the improvement of their yields. E. Briner (*Arch. Sci. phys. nat.*, 1941, [v], **23**, 25—56).—Chemical syntheses which can be carried out by passing gaseous mixtures over an electric arc are discussed. The author's investigations on the synthesis of NO are described, with particular reference to the study of the effects of adding metals of low ionisation potential to the Cu electrodes, and the effects of pressure, frequency, and the composition of the gaseous mixture used. The application of these results in the production of high yields of NO is discussed. J. W. S.

Polymerisation processes induced by mitogenetic radiation. II. Influence on amino-acids and production of a "deaminase" by irradiation. A. Gurvitsch and L. Gurvitsch (*Acta Physicochim. U.R.S.S.*, 1940, **13**, 690—696; cf. A., 1939, I, 620).—The term "deaminase" is used to indicate the mode of action rather than the chemical nature of a substance (I) of high mol. wt. that is formed during the irradiation of aq. glycine. The probable sequence of reactions leading to the formation of (I) is discussed. This formation follows, but is not dependent on, the primary dissociation of the glycine mol., which is confined to the fission of OH. The presence of O_2, though essential to the production of NH_3 by the action of (I) on glycine, is not needed for the formation of (I). The energy of polymerisation of the active monomerides that constitute the units of (I) amounts to 71—76 kg.-cal., and may be available for the activation of the deamination process. F. L. U.

IX.—METHODS OF PREPARATION.

Reduction of magnesium oxide by tungsten in vacuum. G. E. Moore (*J. Chem. Physics*, 1941, **9**, 427—431).—Some chemical reactions which seem improbable under normal conditions proceed at an appreciable rate in vac., *e.g.*, in radio valves. Thus, under these conditions, W will reduce MgO to Mg. The free energy of the reaction $2MgO + W = 2Mg + WO_2$ and the velocity of the reaction in vac. have been calc.; it is possible from energy considerations for the reaction to occur under the conditions prevailing in a radio valve. A. J. M.

Composition of "5 : 3" calcium aluminate. T. Thorvaldson and W. G. Schneider (*Canad. J. Res.*, 1941, **19, B**, 109—115).—On thermal decomp. of pure isotropic $3CaO,Al_2O_3,6H_2O$, 26·6% of CaO is liberated, and the product gives an *X*-ray pattern identical with that of "5 : 3" Ca aluminate. The composition of the latter is therefore $12CaO,7Al_2O_3$. F. J. G.

Dehydration of tricalcium aluminate hexahydrate. W. G. Schneider and T. Thorvaldson (*Canad. J. Res.*, 1941, **19, B**, 123—128).—When $3CaO,Al_2O_3,6H_2O$ (I) is heated in a current of dry air at 275—375° $3CaO,Al_2O_3,1{\cdot}5H_2O$ (II), n 1·543 ± 0·003, is formed. (II) is stable at <275° and from 275° to 300° decomp. is very slow, CaO being liberated. At >350° decomp. is rapid, and $12CaO,7Al_2O_3$ is formed at 500°.

When (I) is heated in N_2 the behaviour is similar. The system (I)–(II) is an effective dehydrating agent at $\not>100°$. C. R. H.

Action of iodates on hypophosphoric acid. W. Jung (*Anal. Asoc. Quím. Argentina*, 1941, **29**, 15—32).—$Na_2H_2P_2O_6$ is stable to KIO_3 in alkaline or neutral solution. The rate of oxidation by 0·1M-KIO_3 in 10N-H_2SO_4 is identical with the rate of hydrolysis by 10N-H_2SO_4, hence the oxidation of $H_4P_2O_6$ in acid is preceded by its hydrolysis to H_3PO_3 and H_3PO_4, the former then being oxidised to H_3PO_4. F. R. G.

Formation of pentathionic acid. R. A. Crespi Gherzi (*Rev. Fac. Cienc. Quím., La Plata*, 1940, **15**, 13—17).—Contrary to certain authors, powdered S with H_2O does not give $H_2S_5O_6$. $H_2S_5O_6$ can be determined colorimetrically by 5% $AgNO_3$ and 2N. aq. NH_3 in presence of $H_2S_3O_6$ or H_2SO_3. F. R. G.

Double salt of potassium tricyanomanganate and potassium hexacyanomanganate. W. D. Treadwell, O. Gübeli, and D. Huber (*Helv. Chim. Acta*, 1941, **24**, 152—157).—When a solution of $MnSO_4$ (0·05 mol.) in aq. KCN (1·5 mols.) is reduced electrolytically, and then titrated potentiometrically, using a short Pt wire electrode, potential jumps are observed corresponding with the complete oxidation of Mn^{I} to Mn^{II} and of Mn^{II} to Mn^{III}, respectively. Such titrations on the mother-liquor and on the ppt. produced after various periods of reduction indicate that the white ppt. formed during the electrolytic reduction is the *compound* $K_2Mn(CN)_3,K_4Mn(CN)_6$, and not $K_2Mn(CN)_3$ as stated by Grube and Brause (A., 1928, 29). J. W. S.

Applications of radioactive indicators for solution of certain problems of the chemistry of complex compounds. A. A. Grinberg (*Bull. Acad. Sci. U.R.S.S., Ser. Phys.*, 1940, **4**, 342—349).—The Br atoms of the complex salts $K_2[PtBr_4]$, $K_2[PtBr_6]$, and $[Pt(NH_3)_2Br_2]$ are very labile, and are readily replaced by *Br (prepared by bombardment with neutrons from a cyclotron source). On this evidence all six Br of $[PtBr_6]''$ are functionally equiv. Exchange of Ir or Pt does not take place between stable complexes, such as $K_2[PtCl_6]$ and $[Pt(NH_3)_2Cl_4]$, $(NH_4)_2[IrCl_6]$ and $[Ir(C_5H_5N)_2Cl_4]$, or $(NH_4)_3[IrCl_6]$ and $H[Ir(C_5H_5N)_2Cl_4]$, using *Ir and *Pt as indicators. The activity of *Ir is several hundred times that of *Pt, and a method of determination of traces of Ir in Pt might be based on this difference. R. T.

X.—ANALYSIS.

Determination of hydrogen in ferrous materials by vacuum extraction at 800° and by vacuum fusion.—See B., 1941, I, 295.

Potentiometric determination of chlorides in presence of bromides. M. Galar (*Rev. Fac. Cienc. Quím., La Plata*, 1940, **15**, 279—287).—Br′ is oxidised by Berg's method (A., 1927, 35) carried out in 2·5N-H_2SO_4, and Cl′ determined potentiometrically by Vanossi's method (A., 1938, I, 47). McAlpine's method (A., 1929, 782) is not suitable for potentiometric determination. F. R. G.

Investigation of halogen acids following elimination of thiocyanic acid. J. F. Salellas (*Rev. Fac. Cienc. Quím., La Plata*, 1940, **15**, 99—106).—Small quantities of halogen ions can be identified in presence of each other and CNS′ by destruction of the latter with 3% $KMnO_4$ and 2N-Na_2CO_3; excess of $KMnO_4$ is removed with H_2O_2. I′ is identified in the original test solution by oxidation with H_2O_2 and dil. HNO_3 followed by agitation with $CHCl_3$. Br′ is identified in the CNS′-free portion by addition of HCl, Cl_2, H_2O, and $CHCl_3$, when a yellow colour precedes the formation of the violet due to I. If I′ and Br′ are absent, Cl′ can be identified in the hot CNS′-free solution by addition of $AgNO_3$; the pptn. must not be carried out in the cold owing to the presence of SO_4'' resulting from the oxidation. To identify Cl′ if I′ and/or Br′ are present with the CNS′, the solution with 25% HNO_3 and a slight excess of $KMnO_4$ is boiled, excess of the latter removed with KNO_2, IO_3' removed by 10% $Pb(NO_3)_2$, and the Cl′ pptd. as before. The sensitivities of the tests are recorded for a no. of mixtures; in general 0·5 mg. of halogen ion can be identified in presence of 100 mg. of CNS′ in 10 c.c. of solution. F. R. G.

Determination of chlorine in water.—See B., 1941, III, 190.

Determination of combined nitrogen in metallic aluminium by the Kjeldahl method.—See B., 1941, I, 297.

Indicators for determination of combined nitrogen in iron and steel.—See B., 1941, I, 294.

Micro-determination of potassium.—See A., 1941, III, 636.

Electrolytic determination of lead as peroxide. D. N. Solanki and T. V. Subbarao (*J. Indian Chem. Soc.*, 1941, **18**, 45—46).—The optimum conditions for the anodic deposition of pure PbO_2 are 3·0—3·1 v., 3 amp., 50—60°, 30 min., Pt gauze anode, and rotating Pt spiral cathode. C. R. H.

Chemical analysis by *X*-rays. III. Appropriate voltages for determination by direct comparison. L. Rivoir and J. M. González Barredo (*Anal. Fís. Quím.*, 1941, **37**, 48—53).—Intensities of the $K\alpha$ line are compared for Cu and Zn for 8—44 kv. F. R. G.

Determination of mercury and copper. S. J. Das-Gupta (*J. Indian Chem. Soc.*, 1941, **18**, 43—44).—The reagent is prepared by dissolving 0·11 g. of 2-chloro-5-thiol-7-methoxyacridine in 100—150 c.c. of EtOH with the addition of 3·5 c.c. of 0·1N-NaOH and filtering. When added in excess to neutral Hg^{II} (10—20 mg. of Hg) or Cu^{II} (5—10 mg. of Cu) solutions a ppt. is formed which is washed with EtOH and dried at 100°. 1 g. of ppt. ≡ 0·2676 g. Hg or 0·09286 g. Cu. The reagent should be freshly prepared and other metals of groups I, II, and III should be absent. C. R. H.

Investigation of the ferric ion by means of thiocyanate. R. Vanossi (*Anal. Asoc. Quím. Argentina*, 1941, **29**, 48—74).—Methods for the identification of $Fe^{\cdot\cdot\cdot}$ are surveyed. Procedure is described for micro- and semimicro-identification of $Fe^{\cdot\cdot\cdot}$ in which the thiocyanate complex is extracted with EtOAc. F. R. G.

Determination of indium. A. T. Nishnik (*Ber. Inst. Chem. Akad. Wiss. Ukrain.*, 1940, **6**, 265—289).—Sn and Sb cannot be separated from In as sulphides or by HNO_3, but Sn_2S_3 and Sb_2S_3 are quantitatively dissolved by shaking with dil. colourless $(NH_4)_2S$, leaving pure In_2S_3. $In(OH)_3$ is quantitatively pptd. by 6N. aq. NH_3 at 60°, which dissolves $Zn(OH)_2$, $Cd(OH)_2$, $Cu(OH)_2$, etc. Freshly pptd. $In(OH)_3$ is readily sol. in an excess of NH_4 salts. In concentrates are dissolved in HCl and treated with hot dil. aq. NH_3. The ppt. is dissolved in hot dil. H_2SO_4 to eliminate Pb. The filtrate is pptd. by hot dil. aq. NH_3, dissolved in HCl, again pptd. by NH_3, and immediately redissolved by AcOH. The solution is treated with H_2S at 80°, and Sn_2S_3 and Sb_2S_3 are extracted from the ppt. by $(NH_4)_2S$. J. J. B.

XI.—APPARATUS ETC.

Characteristics of hollow-cathode discharge tubes. C. C. Van Voorhis and A. G. Shenstone (*Rev. Sci. Instr.*, 1941, **12**, 257—261).—The characteristic effects of the inert gas, and of variations in the dimensions of the cathode, on the min. pressure at which the Schuler discharge may be started and maintained have been examined. A. A. E.

Time lags in coincident discharges of Geiger–Müller counters. M. E. Rose and W. E. Ramsey (*Physical Rev.*, 1941, [ii], **59**, 616—617).—An investigation, by a special counter arrangement, of the abnormally low efficiency of O_2-filled counters (cf. A., 1936, 919) is reported. Results support quant. considerations that the anomaly is due to time lags, resulting from electron capture, between the passage of the ray through the counter and initiation of the discharge (cf. A., 1939, I, 594). N. M. B.

High-speed electronic counter. Anon. (*J. Sci. Instr.*, 1941, **18**, 117).—The counter, which employs several gas-filled triodes and their associated relays, is claimed to count at any speed between 0 and 2000 impulses per min. and to follow any variations in the speed of counting. A. A. E.

Ionisation chamber for counting alpha-particles. W. D. Urry (*Rev. Sci. Instr.*, 1941, **12**, 289—290).—The chamber is designed to permit rapid interchange of sources and to reduce exposure to the atm. to a min. It has been used to determine the rate of emission of α-particles from sources containing the isotopes of U or Th, and from Ra sources. A. A. E.

Use of the polarograph for analysis of meat-curing brines.—See B., 1941, III, 181.

Apparatus for volumetric gas analysis. M. Shepherd (*J. Res. Nat. Bur. Stand.*, 1941, **26**, 351—356).—Apparatus previously described (A., 1931, 457) is improved. O. D. S.

Apparatus for the absorption or gravimetric determination of constituents of a gas mixture. M. Shepherd and H. W. Bailey (*J. Res. Nat. Bur. Stand.*, 1941, **26**, 347—349).—A convenient form of absorption train is described. O. D. S.

Manometric gas analysis apparatus. M. Shepherd and E. O. Sperling (*J. Res. Nat. Bur. Stand.*, 1941, **26**, 341—346).—A modified form of the Van Slyke apparatus with separate vessels for absorption and measurement of the gas is described. O. D. S.

Ring method for determination of interfacial tension. H. H. Zuidema and G. W. Waters (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 312—313).—Mathematical analysis of the tabulated data of Harkins and Jordan (A., 1930, 852) of factors used for surface-tension work gives the relation $(F - a)^2 = (4b/\pi^2R^2)[P/(D - d)] + C$, where $F = S/P$ = correction factor, S = interfacial tension, P = max. pull on ring, D and d are d of the lower and upper phases, R = radius of ring, and C is a const. depending on the ratio r/R, where r is the radius of the wire of the ring, and a and b are universal consts. Use of this equation in the ring method gives results in excellent agreement with those obtained by the capillary method. J. D. R.

Micro-determination of mol. wt. of dark-coloured organic materials. Cryoscopic method. V. A. Aluise (*Ind. Eng. Chem.* [*Anal.*], 1941, **13**, 365—367).—The difficulty of observing the f.p. of dark solutions is overcome by placing a small glass capsule, weighted with a Pb shot, in the mol. wt. tube. The annular space between the capsule and tube wall contains only a thin layer and the first appearance of crystals can easily be detected. The f.p. method requires less time and manipulation than the m.p. procedure and results of the same degree of accuracy (±5%) are obtained. J. D. R.

Apparatus for the study of physico-chemical properties of solutions and for carrying out reactions in liquefied gases under pressure. A. I. Schattenstein (*Acta Physicochim. U.R.S.S.*, 1940, **13**, 604—616).—Apparatus, in which metal (stainless steel) and glass units are combined, is described. F. J. G.

High-vacuum gauge. Anon. (*J. Sci. Instr.*, 1941, **18**, 116).—The "Vacustat," having a range of 10—0·01 mm. Hg, is a small, portable instrument of which the principle of operation is similar to that of the McLeod gauge. Compression is achieved by rotation about the centre. A. A. E.

Recording sensitive differential manometer. W. Hurst (*Rev. Sci. Instr.*, 1941, **12**, 265—268).—Motion is transmitted from a thin rubber diaphragm, carrying a small Al plate, through a glass rod to a glass mirror. Thermal insulation is important. Use of an equalising valve avoids error due to small changes in barometric pressure. Pressure differences $\not<$0·00003 cm. Hg and $\not>$80 cycles per sec. may be recorded. A. A. E.

Low-pressure gauge. C. C. Coffin and J. R. Dingle (*Canad. J. Res.*, 1941, **19**, **B**, 129—131).—An inexpensive, heat-conductivity, low-pressure manometer of average sensitivity which is based on the rate of sublimation of CO_2 from a mixture of solid CO_2 and Et_2O is described. C. R. H.

[Apparatus for] separation and purification of gases by fractional distillation at low temperatures.—See B., 1941, I, 252.

Quantity type rotor for the ultracentrifuge. A. V. Masket (*Rev. Sci. Instr.*, 1941, **12**, 277—279).—Holes accommodating the plugged Lusteroid test-tubes are drilled at 10° to the axis of the duralumin rotor. The seal remains vac.-tight under 3000 lb. per sq. in. at 57,000 r.p.m. The rotor would probably explode at about 72,000 r.p.m. The instrument has been applied to the differential sedimentation and concn. of proteins. A. A. E.

Quantitative separation of some dyes. Application of the chromatographic method. W. Rieman, 3rd (*J. Chem. Educ.*, 1941, **18**, 131—133).—Apparatus and method for separating Victoria-blue B, crystal-violet, and auramine by means of Merck's ignited Al_2O_3 are described. L. S. T.

Apparatus for extraction of lipins from liquids and solids.—See A., 1941, III.

XIII.—GEOCHEMISTRY.

Analysis of water of the thermal springs of Vrnjačka Banja. S. Miholić (*Bull. Soc. Chim. Yougoslav.*, 1939, **10**, 163—196).—Analytical data are recorded. R. T.

Mineral water from Surangudi. T. N. Muthuswami (*Current Sci.*, 1941, **10**, 172—173).—The H_2O contains total solids 286, Cl 7, SiO_2 164, R_2O_3 15, CaO 5, MgO 0·6 p.p.m. Ba, Sr, K, Cr, Sn, Ti, Rb, Mn, Pb, and Cu were also detected spectroscopically [P. K. Seshan]. Features of the geology of the area are noted. A. J. E. W.

Evaporation of salt water in relation to meteorological factors. II. Coefficient of slow evaporation of salt pans of the Unión Salinera de España. C. Chorower (*Anal. Fís. Quím.*, 1941, **37**, 69—113).—The variation of the coeff. of evaporation with humidity is recorded. It also decreases as the d of the saline liquid increases. The coeff. exhibits rapid decreases during the pptn. of NaCl and $MgSO_4$. F. R. G.

Osbornite, meteoritic titanium nitride. F. A. Bannister (*Min. Mag.*, 1941, **26**, 36—44).—Osbornite has been found only in the Bustee meteoritic stone (fell in India in 1852) as minute regular octahedra with golden-yellow colour and metallic lustre, embedded in oldhamite (CaS). It was described by Story-Maskelyne in 1870 as an oxysulphide of Ca and Ti (or Zr). The X-ray patterns give a cubic cell of edge a 4·235 A. with the rock-salt type of structure, identical with that (a 4·23 A.) of TiN. A crystal heated in air at 350° (well below the m.p.) lost its sharp edges and developed polycryst. surfaces, then consisting of a pseudomorph of rutile in regular orientation. The presence of Ti was also confirmed by qual. tests, but not of Ca. TiC has the same structure with a 4·31 A. The "Ti cyanonitride, $Ti(CN)_2,3Ti_3N_2$" of Wöhler, 1850 (A., 1929, 18, 524), found as copper-red cubes in blast-furnace slags and "bears," is Ti(N,C) with a 4·23—4·24 A. "Cochranite, $Ti(CN)_2$" of Stead, 1913, is Ti_2CN with a 4·27 A. L. J. S.

Intermediate regions in plastically deformed crystals of rock-salt. V. I. Startzev (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **30**, 124—125).—The nature of bands parallel to the 110 direction in a plastically deformed crystal of rock-salt has been investigated by the Laue method. It is concluded that the lattice is distorted along the band so that it represents a series of intermediate orientations. Annealing at 600° for 50 hr. had no effect on the bands. A. J. M.

Boron in Chibiny apatites. A. I. Volodtschenkova (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **30**, 140—143).—The Me borate technique was used for the determination of B in apatites. The B_2O_3 content of Chibiny apatites is approx. 0·007%. The presence of B in apatites should be borne in mind in the use of these phosphates as fertilisers. A. J. M.

Identification of clay minerals by means of aggregate X-ray diffraction diagrams. G. Nagelschmidt (*J. Sci. Instr.*, 1941, **18**, 100—101).—By evaporating clay suspensions on a flat surface, the particles are mainly oriented with their basal planes parallel to the plane of sedimentation. The basal spacing reflexions thus obtained with an X-ray spectrometer can be more accurately identified than those obtained with powder diagrams. These spacings are the best characteristics for differentiating between clay minerals or groups of such minerals, especially if several occur in a mixture and their grain-sizes are small. D. F. R.

Paragenesis of elements and minerals in colloids of soils and clays. I. Sedletzki (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **30**, 160—162).—The composition of colloids in soils and its dependence on that of accompanying minerals have been investigated. A. J. M.

Distribution of copper in the main soil types of the U.S.S.R. I. Sedletzki and D. Ivanov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **30**, 51—53).—Data are recorded for a variety of soil types and are correlated with weathering effects. L. J. J.

Modern developments in geological exploration for petroleum. A. Wade (*J. Proc. Austral. Chem. Inst.*, 1941, **8**, 61—70).—A review.

Applications of high pressures in geological and geophysica research. M. P. Volarovitsch (*Bull. Acad. Sci. U.R.S.S., Cl. Sci. Chim.*, 1940, 985—996).—A review. R. T.

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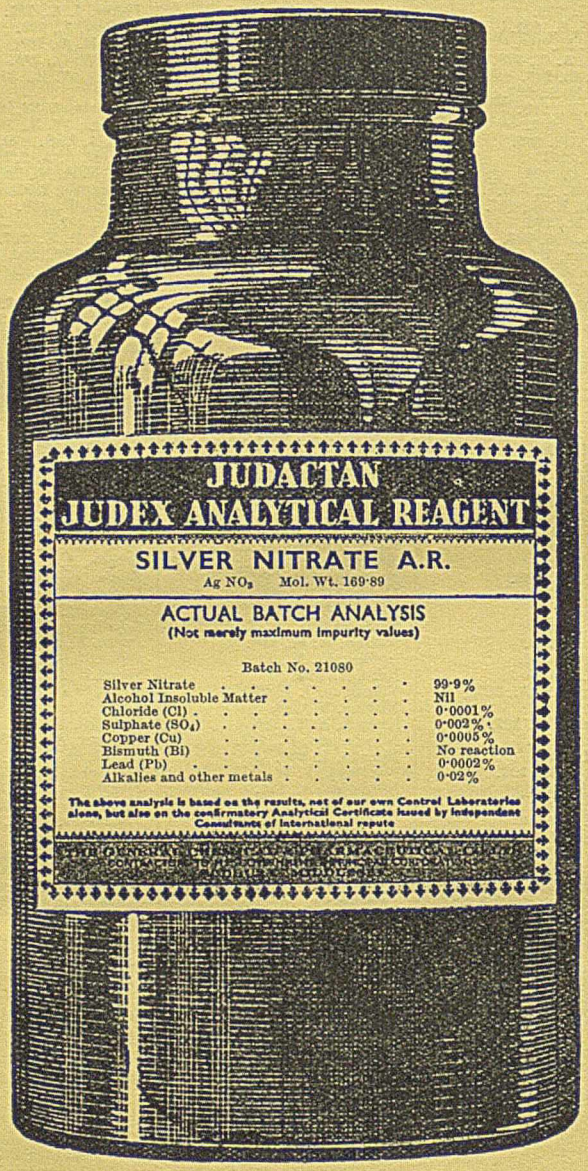
ACTUAL

BATCH

ANALYSIS



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