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

OCTOBER, 1940.

New continuum in the spectrum of helium. A. G. SHENSTONE (Physical Rev., 1938, [ii], 53, 941).—A continuum extending from the red to or beyond 2300 A. appears when a d.c. discharge of several amp. per sq. cm. is run in He at atm. pressure between H_2O-cooled electrodes. It has no obvious connexion with either the line or the band spectrum. L. S. T.

Effect of hyperfine structure on the magnetic rotation of the plane of maximum polarisation of resonance radiation. B. J. MILLER (Physical Rev., 1940, [ii], 58, 258—262).—Mathematical. An equation for the polarisation and the angle of max. polarisation of resonance radiation is developed and applied to the polarisation and angle for the line $^1S_0$—$^1P_1$ for various vals. of the ratio of the hyperfine separation const. A to the natural breadth of the levels, for a nuclear moment of $\frac{1}{2}$. The polarisation and angle of max. polarisation for the Na D lines, for several vals. of the same ratio, are computed and compared with experiment. A range of possible vals. of A, showing some agreement with available data, was thus determined, and a val. found for the mean life agreeing well with that calc. from optical dispersion data. N. M. B.

Further description and classification of the spectrum of singly-ionised cerium. G. R. HARRISON and W. E. ALBERTSON (Physical Rev., 1938, [ii], 53, 940—941).—The known lines of Ce II have been increased from 2800 to >6000 lines, and 12,000 lines of Ce I and Ce II between 8000 and 2400 A. have been photographed. The preliminary classification of Ce II (A., 1938, I, 108) has been extended to include ~2000 lines, and J vals. have been assigned to the levels concerned. Considerable interaction between the two electron configurations $4f5d6s$ and $4f5d^2$ is indicated. L. S. T.

Absorption of praseodymium ion in solutions and in the solid state. F. H. SPEDDING (Physical Rev., 1940, [ii], 58, 255—257).—Assuming that in the solid and liquid phases the sharp absorption spectrum arises from transitions within the incomplete $4f$ shell, i.e., from states arising from the f^2 configuration, the energy states of Pr IV are calc. and show good agreement with observed vals. N. M. B.

Extension of the analyses of the spectra of neutral osmium and iridium. W. ALBERTSON (Physical Rev., 1938, [ii], 53, 940; cf. A., 1938, I, 485).—New λ measurements for the arc spectra of Os and Ir have been made with a 35-ft. grating (30,000 lines per in.). 2169 of the 4500 lines for Os I and 1937 of the 3100 for Ir I have been classified as combinations between numerous energy states. The configuration interaction is pronounced, especially in Ir. The ionisation potential of Os I is 8·7 v. L. S. T.

Extension of the Bi I spectrum. H. E. CLEARMAN, jun. (Physical Rev., 1938, [ii], 53, 941).—Many new lines have been observed in this spectrum in the region 1350—2000 A. by a modification of Selwyn's method (A., 1929, 860). Several series have been traced. L. S. T.

Spectrum of doubly-ionised lead. M. F. CRAWFORD, A. B. McLAY, and A. M. CROOKER (Physical Rev., 1938, [ii], 54, 313).—The spectrum of Pb, excited by an electrodeless discharge in the vapour, has been measured in the region 800—10,000 A. Approx. 400 lines have been classified as transitions between 90 levels of the configurations given, and the classifications are consistent with the observed hyperfine structures of 64 of the lines. L. S. T.

X-Ray emission spectra and electronic energy bands of compounds. J. VALASEK (Physical Rev., 1940, [ii], 58, 213—218; cf. A., 1938, I, 166).—Measurements of emission λλ in the $K\beta$ group of Ca and S in CaS and $CaSO_4$, of Mg and S in MgS, of S in SrS and BaS, and of Ca and Cl in $CaCl_2$ were made from the secondary radiation from pressed blocks of the salts. Determination of the origin of X-ray lines by means of electronic energy band systems is examined for CaS, MgS, and ZnS. The $K\beta_5$ line of Zn in ZnS and the $K\beta_1$ line of Mg in MgS are due to cross transitions from the outermost filled band of the negative ion. N. M. B.

Widths and relative intensities of L-series lines of the rare earth elements. C. H. SHAW (Physical Rev., 1938, [ii], 53, 940).—The technique of forming X-ray targets of these metals suitable for ionisation intensity measurements has been worked out. The L-series lines of W have been measured and compared with those of Au. L. S. T.

Electric susceptibility in a magnetic field. N. DALLAPORTA (Nuovo Cim., 1936, 13, 407—422; Chem. Zentr., 1937, i, 4070).—The dependence of electric susceptibility on the magnetic field strength is expressed by a coeff. of the form $S_0 + S_1/kT + S_2/k^2T^2 + S_3/k^3T^3$. Comparison is made with experimental data (Piékara and Schérer, A., 1935, 13, 1192), and discrepancies are discussed. A. J. E. W.

Characteristics of the copper arc in air. A. B. WHITE (Physical Rev., 1938, [ii], 53, 935—936).—The voltage characteristics of the atm. Cu arc have been recorded under various conditions of arc current, arc length, and electrode condition. Transition from

one form to another of the three forms of arc differentiated depends on conditions of temp. and oxide formation at the electrodes. L. S. T.

Variation of breakdown potential in hydrogen. W. Fucks and G. Schumacher (Naturwiss., 1940, 28, 110).—The lowering of breakdown potential (ΔU) of a gas when the cathode is irradiated is given by $\Delta U/U = k\sqrt{i}$. For H_2, k varies with length of column and pressure. Explanations are considered.
A. J. M.

Probe investigation of anode spots. J. E. Henderson and S. M. Rubens (Physical Rev., 1938, [ii], 54, 238).—Symmetrical patterns of anode spots are readily produced in a glow discharge maintained in the space between two concentric Cu spheres of 53·4 and 5·08 cm. diameter, the inner sphere being the anode. Pressure, c.d., and surface conditions of the anode determine the no. and size of the spots (cf. A., 1930, 270). Similar conditions prevail when the inner sphere is replaced by a thin disc. Probe measurements indicate that the spots are sheaths possessing a positive space charge. L. S. T.

Search for temperature changes accompanying field emission at high temperatures. G. Fleming and J. E. Henderson (Physical Rev., 1938, [ii], 54, 241).—A former search for temp. changes of a field emitter (ibid., 1935, [ii], 48, 486) has been extended to the thermionic region using Au and Pt thermocouples, and W–Pt thermocouples as emitters. Even at temp. at which minute thermionic emission occurs the temp. change is $\ast 2°$. The results indicate that below the temp. at which this emission occurs strongly only a small fraction of the total no. of electrons emitted partakes of the thermal energy of the metals investigated. L. S. T.

Experiments and theory on the performance of the Geiger point counter. J. L. Bohn and J. Morgan (Physical Rev., 1938, [ii], 54, 314).—Optimum conditions of performance have been investigated for various combinations of points, planes, and tubes. A modified form of Zeleny's theory explains the action of the counter. L. S. T.

Positive and neutral rays. V. Ionisation by collision of ions and atoms. A. Rostagni (Nuovo Cim., 1936, 13, 389—406; Chem. Zentr., 1937, i, 3918—3919; cf. A., 1935, 274; 1936, 539, 1312).—A transverse-field apparatus for the study of collision ionisation in gases is described. Data are given for the effective cross-sections (A) of A, Ne, and He for ionisation by their own atoms or ions, with velocities (v) of 50—1100 v. As v increases A rises from a threshold val. which is approx. the same for atoms and ions of the same gas; the ratio of the A vals. for atoms and ions is also $\sim$1. A. J. E. W.

Ion optics of a five-section proton-accelerating tube. J. S. Allen and J. H. Williams (Physical Rev., 1938, [ii], 53, 928).—Theoretical calculation, and experimental verification, of focal lengths of electrostatic lenses consisting of pairs of coaxial cylinders. L. S. T.

Reversible clean-up effect in low-pressure mercury-vapour discharges. C. Kenty (Physical Rev., 1938, [ii], 53, 936).—In a steady positive-column discharge in Hg vapour at low pressures an equilibrium condition of clean-up exists at the walls, and a large exchange of Hg between the space and the walls takes place continually. Excited atoms, and gases other than Hg, are not involved. The effect is attributed to the penetration of ions to different depths into the surface. Hg is dislodged as well as cleaned up by ion bombardment, and the balance between these two effects determines mainly the equilibrium amount of Hg on the wall. A similar clean-up is found for an Fe surface. The effect has a considerable practical significance. L. S. T.

Nuclear magnetic moment of ^{13}C. R. H. Hay (Physical Rev., 1940, [ii], 58, 180—181).—Using KCN and NaCN containing $\sim$22% abundance of ^{13}C, the mol. beam magnetic resonance method gave curves with a min. for which the g val. is $1·401\pm0·004$. The sign of the nuclear magnetic moment, determined by the field reversal method, is positive. Evidence in favour of a spin of $\frac{1}{2}$ leads to a nuclear magnetic moment of $0·700\pm0·002$ nuclear magneton.
N. M. B.

Efficiency of γ-ray counters. F. Norling (Physical Rev., 1940, [ii], 58, 277).—Comparative efficiency curves for γ-ray counters of brass, Al, and Pb are given and discussed. The Pb counter is very effective in the region of 0·5 Me.v. For Ra-C γ-rays filtered through 2·5 cm. Pb ($\sim$2 Me.v.) the relative efficiencies are Pb 100, brass 84 ± 4, Al 109 ± 4, and for unfiltered Ra γ-rays, Pb 100, brass 67 ± 3, Al 75 ± 3. The correlation of a γ-component to other particles, without use of an efficiency curve, by measuring the decrease of coincidence rate when absorbers are inserted in front of the γ-ray counter is examined for the case of $^{56}*Mn$. N. M. B.

β-Radioactivity of rubidium. G. Occhialini (Ann. Acad. Brasil. Sci., 1940, 12, 155—158).—Consideration of the results of Ollano (A., 1938, I, 56) shows that harder β-rays must be present corresponding with the recorded penetration of $6—7 \times 10^{-3}$ cm. This is in agreement with the author's val. from the magnetic spectrograph (A., 1932, 138).
F. R. G.

β-Ray spectrum of ^{128}I. R. H. Bacon, E. N. Grisewood and C. W. van der Merwe (Physical Rev., 1938, [ii], 54, 315).—Measurements of this spectrum in a Wilson cloud chamber indicate the existence of two groups, with end-points at 2·1 and 1·05 Me.v., respectively. The group with the lower energy appears to be new. L. S. T.

Radioactive isotope of samarium. T. R. Wilkins and A. J. Dempster (Physical Rev., 1938, [ii], 54, 315).—Combination of the mass spectrograph with the photographic emulsion track technique gives results that indicate the real half-life of ^{148}Sm to be 14% of the apparent half-life. L. S. T.

Cloud-chamber study of the α-rays of actinouranium. T. R. Wilkins and D. P. Crawford (Physical Rev., 1938, [ii], 54, 316).—The mean ranges of α-rays from U-I and U-II have been checked (cf. A., 1937, I, 388), and a residuum of α-rays, attributed to actino-U, has been confirmed. The

mean range of actino-U appears to be nearer that of U-II, and is probably 2·99 cm. in air at 15°.   L. S. T.

Dependence of neutron interaction with nuclei on neutron energy. P. N. POWERS, H. H. GOLDSMITH, H. G. BEYER, and J. R. DUNNING (Physical Rev., 1938, [ii], **53**, 947).—The dependence of neutron interaction on energy has been investigated for B, H, D, Fe, Au, and Ir by using a well-collimated beam of neutrons from a paraffin-surrounded source, which was kept at 295° or at 105° K. Total cross-sections for capture and scattering are recorded.   L. S. T.

Dependence of magnetic scattering of neutrons on the magnetisation of iron. H. G. BEYER, H. CARROLL, C. W. WITCHER, and J. R. DUNNING (Physical Rev., 1938, [ii], **53**, 947).—The variation in the magnetic scattering of neutrons with the intensity of magnetisation has been investigated by passing a well-collimated slow neutron beam through three Armco plates placed between the poles of a large electro-magnet. The increase in no. of neutrons transmitted through the magnetised Fe does not follow the magnetisation curve of the Fe.   L. S. T.

Spin of the neutron. H. H. GOLDSMITH and L. MOTZ (Physical Rev., 1938, [ii], **53**, 947).—Consideration of the variation of the n–p scattering cross-section with neutron energy on both possible spin vals. of $\frac{1}{2}\hbar$ and $\frac{3}{2}\hbar$, and comparison of the predicted and experimental cross-sections at 2·5—3·0 Me.v., support the val. $\frac{1}{2}\hbar$ (cf. A., 1938, I, 115).   L. S. T.

Absorption of slow neutrons by chlorine. E. O. SALANT and W. J. HORVATH (Physical Rev., 1938, [ii], **53**, 943).—Irradiation of CCl_4 with slow Ra–Be neutrons shows that the 35-min. period of Cl (Amaldi *et al.*, 1935, 910) is induced largely by C neutrons, and that the initial activity of Cl is small. Data for the absorption of neutrons of different energies by Cl are recorded and discussed.   L. S. T.

Nuclear isomerism of ^{87}Sr. H. REDDEMANN (Naturwiss., 1940, **28**, 110).—Pure ^{87}Sr obtained from Canadian mica was irradiated with Ra–Be neutrons and with D + D neutrons. In both cases a β-activity was found, with half-life 3·0±0·1 hr., which is due to an unstable isomeride of ^{87}Sr.   A. J. M.

Distribution in angle of protons from the deuteron–deuteron reaction. R. D. HUNTOON, A. ELLETT, D. S. BAYLEY, and J. A. VAN ALLEN (Physical Rev., 1940, [ii], **58**, 97—102).—Using a special gas-target chamber and a bombarding energy range 60—390 ke.v., results are given by $N(\theta) = 1 + A \cos^2 \theta$, where θ is the angle which the velocity of the proton makes with the direction of the deuteron beam as measured in the centre-of-mass co-ordinate system and $N(\theta)$ is the no. observed per unit solid angle at θ. The val. of A depends markedly on bombarding energy.   N. M. B.

α-Particles from the disintegration of lithium by deuterons. H. STAUB and W. E. STEPHENS (Physical Rev., 1938, [ii], **54**, 236).—The no.-range curve of α-particles arising from the disintegration of Li by deuterons at the 800-kv. peak has been obtained. The continuous distribution due to the reaction $^7Li + {}^2D \rightarrow {}^1n + {}^8Be$; $^8Be \rightarrow 2{}^4He$ was observed, ranging up to ~7·7 cm. Superimposed is a homogeneous group, agreeing in its 7·6 cm. mean range with that observed by Williams *et al.* (A., 1937, I, 593) and ascribed to the reaction $^7Li + {}^2D \rightarrow {}^4He + {}^5He$. This leaves the ^5He unstable by 0·8 Me.v. The peak at 7·6 cm. is wider than that observed at 13·0 cm., owing to the reaction $^6Li + {}^2D \rightarrow 2{}^4He$, which has a width of ~0·9 cm. at half-max. This width is due to the deep penetration of the deuterons at the high bombarding voltage of 0·8 Me.v. The nos. of disintegrations at 0·8 Me.v. for the three processes are in the ratio 50 : 10 : 1.   L. S. T.

Energy released in the reaction $^6Li\ (p,\ \alpha)\ {}^3He$ and the mass of ^3He. S. K. ALLISON, L. C. MILLER, G. J. PERLOW, L. S. SKAGGS, and N. M. SMITH, jun. (Physical Rev., 1940, [ii], **58**, 178).—The energy vals. obtained, using two methods of determination with variable-pressure absorption cells, were 3·95±0·06 and 3·94±0·05 Me.v. Computed masses based on H = 1·00813±0·00002, D = 2·01473±2, and ^4He = 4·00386±7 are ^3He = 3·01685±10, ^6Li = 6·01684±11, ^7Li = 7·01814±11, ^8Be = 8·00765±15, and ^9Be = 9·01484±13.   N. M. B.

Energy released in the disintegration of ^6Li by protons. G. J. PERLOW (Physical Rev., 1940, [ii], **58**, 218—225).—Using a high-dispersion arrangement of a small variable-air-pressure absorption cell and ionisation chamber, the energy release in the reaction $^6Li\ (p,\ \alpha)\ {}^3He$ was accurately determined by a comparison of the ^4He range with that of the α-particles from $^9Be\ (p,\ \alpha)\ {}^6Li$. The val. found was 3·945± 0·06 Me.v. compared with 3·72±0·08 found by Neuert (cf. A., 1935, 1297). With the new val., ^3H is unstable against β-decay by 0·19±0·09 or 0·10± 0·1 Me.v., depending on the val. for the ^2D–^4He bracket. The ^3He mass is 3·01688±0·00011.   N. M. B.

Formation of ^7Be. R. B. ROBERTS and N. P. HEYDENBURG (Physical Rev., 1938, [ii], **53**, 929).— The range-no. curves of the α-particles emitted by B bombarded by 200-kv. protons show little evidence for the reaction $^{10}B + {}^1H \rightarrow {}^7Be + {}^4He + Q_1$. The energies of the neutrons emitted by ^6Li under deuteron bombardment indicate that ^7Be is formed according to $^6Li + {}^2D \rightarrow {}^7Be + {}^1n + Q_3$, and is converted into ^7Li only by K electron capture.   L. S. T.

γ-Ray resonances from the bombardment of carbon by deuterons. W. E. BENNETT and T. W. BONNER (Physical Rev., 1940, [ii], **58**, 183—185).— The excitation curve for the bombardment by 550— 2000-ke.v. deuterons of thin C targets made by evaporation of paraffin on to Ag discs shows the first known case of resonant emission of γ-rays from deuteron bombardment. The resonances are at 920, 1160, 1300, 1430, and 1740 ke.v. The γ-rays are hard and show about the same absorption in Pb as do the γ-rays from RaTh. There is evidence that the reaction is $^{12}C + {}^2H \rightarrow (^{14*}N) \rightarrow {}^{14}N + \gamma_1 + Q$, where $Q = 10·4$ Me.v.   N. M. B.

Resonances in the emission from the reaction $^{12}C + {}^2H$ of (A) neutrons, (B) protons. T. W. BONNER, E. HUDSPETH, and W. E. BENNETT [(B) with M. M. ROGERS] (Physical Rev., 1940, [ii], **58**, 185—

186, 186; cf. Amaldi, A., 1937, I, 438).—(A) The excitation curve for the emission of neutrons from a thin C target in the reaction $^{12}C + ^{2}H \rightarrow (^{14}*N) \rightarrow$ $^{14}N + ^{1}n - 0.25$ Me.v. shows resonances at 920, 1160, 1300, and 1825 ke.v. The neutrons were detected with a H_2-filled electroscope and results were checked by measurements of the radioactivity of ^{13}N. The curve is corr. for resonances due to the γ-rays from C (cf. preceding abstract), and the resonances found correspond with excited states of the ^{14}N nucleus at 11·19, 11·39, 11·51, and 11·96 Me.v.

(B) The excitation curve for the emission of 15-cm. protons from a thin C target in the reaction $^{12}C + ^{2}H \rightarrow (^{14}*N) \rightarrow ^{13}C + ^{1}H + 2.7$ Me.v. shows resonances at 920 and 1220 ke.v. The relative yield of protons to neutrons at 920 ke.v. is 1·9, indicating that the excited ^{14}N nucleus is about equally likely to break up into a proton or a neutron. It is possible that the resonances at 1160 and 1220 ke.v. are the same level in ^{14}N, the exact position of the peak depending on the particle emitted, and that the neutron resonance at 1825 ke.v. may be the same level in ^{14}N as the 1740 level for γ-ray emission.
N. M. B.

Mechanism of the neutron loss reaction produced by deuterons. M. GOLDHABER (Nature, 1940, **146**, 167).—The possibility that the effect reported by Krishnan and Banks (A., 1940, I, 278) may be due to the reaction $^{63}Cu (d, ^{3}H) ^{62}Cu$ is examined.
L. S. T.

Long-period activity induced in copper. S. W. BARNES and G. VALLEY (Physical Rev., 1938, [ii], **53**, 946).—The Cu parts of a cyclotron chamber in which only protons have been accelerated show a radioactivity of ~7 months. Positrons and electrons are emitted in the ratio 2 : 1, and strong γ-radiation is present.
L. S. T.

Radioactivity produced by bombarding thallium. K. FAJANS and A. F. VOIGT (Physical Rev., 1940, [ii], **58**, 177; cf. Pool, A., 1937, I, 239).—Highly purified Tl bombarded with slow and fast neutrons and deuterons gave an activity of average half-life 4·23±0·03 min., and the val. for Ac-C'' (^{207}Tl) separated chemically from the active deposit of Ac was 4·77±0·05 min., showing that the products are not identical. Evidence is given that the 4·23-min. activity is ^{204}Tl produced from ^{203}Tl by neutron capture and from ^{205}Tl by the $(n, 2n)$ reaction. No indication of a 97-min. period was found, but 1—2 hr. deuteron or 4 hr. slow neutron bombardment gave a weak activity of 1—2 years half-life, probably due to ^{206}Tl produced from ^{205}Tl by (D, p) and (n, γ) reactions. Bombardment by deuterons also gave a strong activity of 52±1 hr., chemically identified as Pb; the absorption curve in Al indicates an energy of 500 ke.v. Results suggest that the activity is due to a metastable state in ^{204}Pb or ^{206}Pb which emits a γ-ray which is internally converted into the observed β-rays.
N. M. B.

Induced radioactivity of rhenium and tungsten. K. FAJANS and W. H. SULLIVAN (Physical Rev., 1940, [ii], **58**, 276).—Fast neutron bombardment of Re and deuteron bombardment of W gave a new activity of 52±2 days half-life, identified as ^{184}Re.

The reactions are probably $^{185}Re (n, 2n) ^{184}Re$ and $^{183}W (d, n) ^{184}Re$ or $^{184}W (d, 2n) ^{184}Re$. It is a negatron emitter having a γ-ray of 0·85±0·1 Me.v. associated with it. The following identifications of known isotopes are confirmed : ^{188}Re (18 hr.), ^{186}Re (90 hr.), ^{187}W (24 hr.), and ^{185}W (74·5 days) (cf. Minakawa, A., 1940, I, 340). The upper limit of the β-ray energy of ^{187}W is 1·40±0·05 and that of ^{185}W is 0·55—0·72 Me.v.; a γ-ray of 0·87±0·03 Me.v. is associated with ^{187}W. Both activities are negatron emitters.
N. M. B.

Artificial radioactivity of chromium. T. AMAKI, T. IIMORI, and A. SUGIMOTO (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1940, **37**, 395—398).— Bombardment of Cr with slow and fast neutrons and with fast deuterons produces radioactive isotopes ^{51}Cr (~14 days) and ^{55}Cr (1·7 hr.). The latter is not found with fast neutron bombardment. A 3—4 hr. activity found with fast neutrons is ascribed to ^{50}V.
L. J. J.

Structure of the lower excited levels of the ^{80}Br nucleus. A. P. GRINBERG and L. I. ROUSSINOV (Physical Rev., 1940, [ii], **58**, 181).—Absorption measurements in Al with selective filters give ~37 ke.v. for the energy of the γ-rays from ^{80}Br obtained by a cyclotron. The decay period of the γ-radiation is 4·5 hr. On a scheme fitting experimental results the total excitation energy of the metastable Br nucleus is 85 ke.v., and from this level there are transitions by internal conversion to a lower excited level at 37 ke.v., from which there is a γ-transition only partly associated with internal conversion (cf. Valley, A., 1940, I, 4). The estimated val. of the internal conversion coeff. for the lower transition is 0·5 (assuming 1 for the upper transition), a val. which may be associated only with a dipole electric transition.
N. M. B.

Seven-day uranium activity. E. McMILLAN (Physical Rev., 1940, [ii], **58**, 178).—Radioactive ^{237}U reported by Nishina (cf. A., 1940, I, 340) has been found in samples of U placed behind a Be target bombarded by 16-Me.v. deuterons, and showed 7·0±0·2 days half-life. Immediate purification showed the 23-min. U and its 2·3-day product (cf. McMillan, *ibid.*) but with purification after a delay only the 7-day period was seen. The initial intensity ratio of the 7-day to the 2·3-day activity was ~1 : 8. The same result was found from the decay curve of a thin U layer placed behind the target. Evidence is given that the daughter product must be element 93. After allowing an 80-μ-curie sample of 7-day U to decay for 26 days, element 93 was extracted from it by the method of fluoride pptn. in reducing and oxidising media, with Ce carrier. The resulting product showed no measurable β- or α-ray activity, so its period must be very long.
N. M. B.

Regularities among the heavy nuclei. L. A. TURNER (Physical Rev., 1940, [ii], **58**, 181—182).— An amplification of previous discussions (cf. A., 1940, I, 307) in the light of new experimental data.
N. M. B.

Mass of cosmic-ray particles. R. M. LANGER (Physical Rev., 1938, [ii], **54**, 237).—A discussion.
L. S. T.

Cosmic rays and Poisson's law. A. Gibert (Nature, 1940, **146**, 198).—The validity of applying Poisson's law to cosmic-ray nos. has been investigated.   L. S. T.

Latitude effects in cosmic rays at far southern latitudes. E. T. Clarke and S. A. Korff (Physical Rev., 1940, [ii], **58**, 179—180).—Intensities as measured by an electroscope and by a counter on an Antarctic route are plotted and discussed. Results show that the average sp. ionisation per ray at sea level remains const. with change of latitude above the curve inflexion at ~38° S. geomagnetic latitude, indicating that the ratio of electrons to mesotrons is const.   N. M. B.

Pair production of mesotrons at 29,000 feet. G. Herzog and W. H. Bostick (Physical Rev., 1940, [ii], **58**, 278; cf. A., 1940, I, 188).—Curvature and ionisation considerations of cloud-chamber tracks in a magnetic field of 700 gauss up to 29,000 ft. indicate that the pair consists of a slow positive and a slow negative mesotron.   N. M. B.

Radiative processes involving fast mesons. F. Booth and A. H. Wilson (Proc. Roy. Soc., 1940, A, **175**, 483—518).—The general theory of the interaction of mesons with an electromagnetic field is developed and applied to the scattering of light by mesons, the emission of radiation by mesons during collisions, and the production of pairs of mesons. The experimental data concerning the energy losses of "heavy electrons" in cosmic rays are discussed and are shown to be consistent with the view that the heavy electrons have spin 1.   G. D. P.

Mesotron–electron collisions. S. Tomonaga (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1940, **37**, 399—413).—For the case of collisions involving mesotrons, Williams' "collision-parameter" method is extended to take the effect of spin into account. The method is applied to at. ionisation and the production of electron–positron pairs by mesotrons.   L. J. J.

Barytron theory of nuclear forces. H. A. Bethe (Physical Rev., 1938, [ii], **53**, 938).—A discussion.   L. S. T.

Nuclear excitation functions for high-energy charged particles. M. S. Plesset and D. H. Ewing (Physical Rev., 1938, [ii], **53**, 943).—A Coulomb model is proposed.   L. S. T.

Radiative losses by particles of anomalous magnetic moment. S. B. Batdorf and E. W. Beth (Physical Rev., 1938, [ii], **54**, 237).—Theoretical.   L. S. T.

Dirac equation with spin greater than 1/2. A. Bramley (Physical Rev., 1938, [ii], **54**, 314—315).—Theoretical.   L. S. T.

Virtual levels of ⁸Be and the α-particle model. (Miss) J. E. Rosenthal (Physical Rev., 1938, [ii], **54**, 315).—Theoretical. A mol. model does not account for the existence of virtual levels.   L. S. T.

Magnetic moments of odd nuclei. H. Margenau and E. Wigner (Physical Rev., 1940, [ii], **58**, 103—110; cf. Inglis, A., 1940, I, 92).—Mathematical. Consideration of a generalisation of Schmidt's single-particle model (cf. A., 1937, I, 440) indicates that the orbital part of the magnetic moment is essentially that following from the liquid drop model and the spin part is identical with that of Schmidt. The model fails to explain the near equality found experimentally for the moments of isotopes.   N. M. B.

Directional correlation of successive quanta. D. R. Hamilton (Physical Rev., 1940, [ii], **58**, 122—131).—Mathematical. The correlation between the directions of propagation of the quanta emitted in two successive transitions of a single radiating system (cf. Dunworth, A., 1940, I, 278) is described by a function $W(\theta)$ giving the relative probability that the second quantum will be emitted at an angle θ with the first; W is determined by the angular moments of the three levels involved in the two transitions and by the multipole order of the radiation emitted in these transitions. The explicit forms of W for all angular momenta and for dipole and quadrupole radiation are given.   N. M. B.

Theoretical constitution of metallic beryllium. C. Herring and A. G. Hill (Physical Rev., 1940 [ii], **58**, 132—162).—Mathematical. By a self-consistent field method, calculations (for the first time for metals other than univalent) are made of total energy as a function of lattice const. and of other properties of Be. The validity for higher valencies and the practicability of the calculational methods are examined. Results for binding energy, lattice const., and compressibility show fair agreement with experiment, but discrepancy of the calc. work function suggests a large deviation of the exchange energy from the val. for completely free electrons. Electronic energies and wave functions in the crystal were calc. by the "orthogonalised plane wave" method (cf. A., 1940, I, 342).   N. M. B.

Spinor equations for particles with arbitrary spin and rest mass zero. J. S. de Wet (Physical Rev., 1940, [ii], **58**, 236—242).—Mathematical. A simplified derivation of the results of Fierz (Helv. Phys. Acta, 1940, **13**, 45).   N. M. B.

Partially inverted multiplets in Mg I. L. Pincherle (Physical Rev., 1940, [ii], **58**, 251—254; cf. Meissner, A., 1938, I, 219).—Mathematical. Using Fermi–Thomas statistical eigenfunctions, the separations of the $3s\,3d^3\,D$ term of Mg I are evaluated, taking into account all the magnetic interactions in the atom and the electrostatic interactions with other configurations. The smallness of the observed separations is due to the large val. of the exchange integrals of the magnetic actions.   N. M. B.

Transport cross-section of helium. E. J. Hellund (Physical Rev., 1940, [ii], **58**, 278—279).—Mathematical. An attempt to determine the form of the cross-section necessary to fit experimental low-temp. η data.   N. M. B.

Mercury–thallium molecular bands. J. G. Winans and F. J. Davis (Physical Rev., 1938, [ii], **53**, 930).—Four bands or band systems emitted by heated Hg + Tl in a quartz tube, and attributable

to Hg–Tl mols., are recorded. With high pressure of Hg and high [Tl] the bands are very strong.
L. S. T.

New absorption bands of water vapour in the extreme ultra-violet. J. J. HOPFIELD (Physical Rev., 1938, [ii], 53, 931).—Bands in the regions 996—1239 A. and 1260—1377 A. are recorded. Another system can be traced between 900 and 970 A., and fades to continuous absorption on the short-λ side of 900 A. The bands have a diffuse appearance characteristic of triat. mols.
L. S. T.

Rotational analysis of some CS₂ bands in the near ultra-violet system. L. N. LIEBERMANN (Physical Rev., 1940, [ii], 58, 183; cf. Mulliken, A., 1936, 13).—Some bands of the λ 3200 absorption system were resolved; they include parallel and perpendicular types. B vals. obtained from the analysis of the λλ 3501, 3467, 3637, and 3601 rotational bands are given. The perturbation of the rotational levels of the common upper state of the λ 3501 and λ 3601 bands is discussed.
N. M. B.

Comparison of the absorption spectra of gaseous and solid benzene. A. L. SKLAR, H. SPONER, and G. NORDHEIM (Physical Rev., 1938, [ii], 53, 932). —Similarities in both spectra are pointed out, and new progressions are recorded and discussed.
L. S. T.

Infra-red absorption of mixtures of phenol and ethyl alcohol. J. W. WHITE and E. K. PLYLER (Physical Rev., 1938, [ii], 53, 932).—An absorption band in the region of 6·7 μ. shows changes in intensity and position for the different concns. The shape or sharpness of the bands in the region 6—12 μ. is largely affected by the concn. of the solution, and the change in the bands indicates marked association between PhOH and EtOH. Near 2·7 μ. the effects are more pronounced, possibly owing to interaction of the OH groups of the two substances.
L. S. T.

Relative emission spectra of zinc silicates and other cathodo-luminescent materials. H. W. LEVERENZ (Physical Rev., 1938, [ii], 53, 919—920).— Spectroscopically-pure α-ZnSiO₄ has a broad, weak luminescence peaked at 4200 A. As Mn activator is added this band gradually disappears, and a narrow, strong band, peaked at 5250 A., is produced. Spectral efficiency curves for Mn-activated β-Zn silicates, α-Zn germanates, α-Zn Be silicates, etc. have been obtained. Group IVA silicates resurrect the emission spectrum of the pure ZnSiO₄, and permit the synthesis of phosphors having practically white emission colours.
L. S. T.

Luminescent materials. II. Fluorescence spectra of zinc sulphide–copper crystal phosphors at −185°, 20°, and 150°. Y. UEHARA (Bull. Chem. Soc. Japan, 1940, 15, 214—223; cf. A., 1940, I, 147).—Pure ZnS phosphors exhibit 4 fluorescence bands at 4670, 4870, 5085, and 5455 A., whilst those activated by Cu give 3 bands at 4245, 4410, and 5260 A. Corresponding electronic transitions are suggested. The result of varying the amount of activator or the temp. is in accord with theoretical expectation. The energy distribution curves are markedly affected by the presence of KCl used as a flux.
F. L. U.

Ionisation and dissociation of normal and *iso*-butane by electron impact. R. F. BAKER and J. T. TATE (Physical Rev., 1938, [ii], 53, 944).—The processes and products of ionisation and dissociation by electron impact in *n*- and *iso*-C₄H₁₀ have been investigated with a mass spectrometer. The ionisation potential of 9·8±0·2 v. is the same for both isomerides. The most abundant ion in both mols. is Pr⁺, indicating that fission of a Me with ionisation of the remaining radical is more probable than ionisation of the complete mol. Et⁺ is more abundant in *n*- than in *iso*-C₄H₁₀. The appearance potentials show that the C–H linking energy in C₄H₁₀ is > the C–C linking energy.
L. S. T.

Photo-conductance of silver bromide containing silver iodide. N. KAMEYAMA and K. MIZUTA (J. Soc. Chem. Ind. Japan, 1939, 42, 426B).—AgI in AgBr in mol. ratios 1·6—2·5% increases the spectral conductance in the spectral range in which pure AgBr is sensitive, and widens the sensitive range towards longer λ.
W. A. R.

Paramagnetic rotation of the plane of polarisation. J. BECQUEREL and W. J. DE HAAS (Comm. Kamerlingh Onnes Lab., 1936, Suppl. 81a, 11 pp.; Chem. Zentr., 1937, i, 3601; cf. A., 1936, 148).—An accurate study of tysonite at very low temp. shows that paramagnetic rotation resembles paramagnetism in possessing temp.-dependent and -independent components; the former requires a mol. field, as in Weiss paramagnetism. The rotation of siderite is anomalous. At liquid He temp. the Faraday effect is very small, negative, and independent of temp.; at liquid H temp. it increases rapidly, and from liquid N temp. upwards it falls with rising temp. Van Vleck and Hebb's theory of the paramagnetic rotation of rare-earth salts is verified, except for Sm and Eu.
A. J. E. W.

Electric breakdown of alkali halides. R. J. SEEGER and E. TELLER (Physical Rev., 1940, [ii], 58, 279—280; cf. A., 1938, I, 601; 1939, I, 551).— Mathematical. An improved equation for the breakdown field is derived and vals. calc. therefrom are compared with experimental data. Deviations suggest the omission of various physical factors.
N. M. B.

Resonance in the chloroacetic acids. R. P. BELL (Nature, 1940, 146, 166—167).—Evidence lending some support to the view that a resonance structure plays a part in the CHCl₂·CO₂' ion (A., 1940, I, 285) is quoted, but the effects observed are < expected if resonance is a major cause of a 30-fold increase in K on passing from CH₂Cl·CO₂H to CHCl₂·CO₂H.
L. S. T.

Viscosity and molecular structure. H. MARK and R. SIMHA (Nature, 1940, 146, 167—168).—A correction (cf. A., 1940, I, 289).
L. S. T.

Free fall of molecules. I. ESTERMANN, O. C. SIMPSON, and O. STERN (Physical Rev., 1938, [ii], 53, 947—948).—Observation of the deflexion of mols. by gravity shows that the intensity distribution is in agreement with Maxwell's law of velocity distribution.
L. S. T.

Rotational magnetic moments of H_2, D_2, and HD molecules. Rotational radio-frequency spectra of H_2, D_2, and HD in magnetic fields. N. F. RAMSEY, jun. (Physical Rev., 1940, [ii], **58**, 226—236; cf. A., 1940, I, 275).—The spectra for transitions corresponding with re-orientations of the rotational angular momenta of the mols. were obtained, and from these spectra the rotational magnetic moments (all positive) of H_2, HD, and D_2 in the first rotational states are 0·8787±0·0070, 0·6601±0·0050, and 0·4406±0·0030 nuclear magneton, respectively. The relative vals. are in the ratio 4 : 3 : 2 as expected theoretically. The rotational magnetic moment of H_2 in the second rotational state was twice that in the first. The deduced high-frequency contribution to the diamagnetic susceptibility of H_2 is (0·093± 0·007) × 10^{-6} per mol. Mol. interaction consts. agree with those from the nuclear re-orientation spectrum. The dependence on orientation of the diamagnetic susceptibility of H_2 in the first rotational state is such that $\xi_{\pm 1} - \xi_0 = -(4 \cdot 5 \pm 2 \cdot 0) \times 10^{-31}$ per mol.   N. M. B.

Investigation of cold-worked polycrystalline α-iron. L. MULLINS and J. W. RODGERS (Proc. Roy. Soc., 1940, **A**, **175**, 422—435).—Microphotometer records of the intensity variation in the X-ray reflexions from individual grains are analysed into components arising from the discrete crystal fragments of the deformed grain. The results fall into three groups representing different types of disintegration of the metallic grain.   G. D. P.

Orientation of liquid crystals by heat conduction. G. W. STEWART, D. O. HOLLAND, and L. M. REYNOLDS (Physical Rev., 1940, [ii], **58**, 174—176; cf. A., 1936, 670).—Concordant results are presented of three experimental tests of this new phenomenon in which liquid crystals of p-azoxy-anisole acquire a preferred orientation under the action of heat conduction in the liquid. A temp. gradient of 1—2° per cm. at ~125° gives a marked effect, and the orientation is indicated by the variation in intensity of the X-ray diffraction halo. The effect is probably due to the dominance of acoustic waves of inertia and viscosity in heat conduction in liquids.   N. M. B.

Theory of the diffuse scattering of X-rays from crystals. G. E. M. JAUNCEY and G. G. HARVEY (Physical Rev., 1940, [ii], **58**, 179; cf. A., 1939, I, 599).—Mathematical. A discussion of Zachariasen (cf. A., 1940, I, 285).   N. M. B.

Patterson analysis derived from the cyclol C_2 skeleton. D. RILEY (Nature, 1940, **146**, 231).—A reply to criticism (cf. A., 1940, I, 350). The Patterson map obtained by placing the cyclols in the insulin (I) unit cell with a tilt of 6° has been re-calc. numerically, and the essential part of the resulting contour diagram is reproduced and discussed. The new Patterson analysis is not in sufficient agreement with experimental data for (I) to afford evidence in favour of the cyclol hypothesis.   L. S. T.

Symmetrical arrangement of equal spheres. S. MELMORE (Nature, 1940, **146**, 199).   L. S. T.

Finite complexes in crystals : a classification and review. A. F. WELLS (Phil. Mag., 1940, [vii], **30**, 103—134).—Where the interat. binding in crystals is not all of one type, aggregates of atoms within which the binding is of one kind may be distinguished from those in which it is of another kind. These groups may be finite (mols. and complex ions) or may extend as infinite chains or layers through the crystal. The finite complexes are classified and discussed. The constitution of the heteropoly-acids which have ions of the type $(P_x W_y O_z)^{n-}$, where P may be replaced by As, Si, B, I, etc., and W by Mo, V, etc., and where $y/x \gg 6$, is discussed.   A. J. M.

Scattering of 50-kv. electrons by aluminium. C. T. CHASE and R. T. COX (Physical Rev., 1940, [ii], **58**, 243—251; cf. Rose, A. 1940, I, 185).—Apparatus is described for scattering electrons with thin foils and measuring the intensity of scattering in a narrow pencil at 30—120° with the direction of incidence. The theory of nearly single scattering is discussed, and a general expression for the error due to slight plural scattering is found. For 50-kv. electrons scattered by thin composite foils of Al on collodion an unexplained difference was found between the intensities of scattering at 90° on the two sides of a foil inclined at 45° to the direction of incidence. Relative intensities, corr. for this asymmetry, for angles 30—120° were within 5% of those predicted by Mott. Observed abs. intensity of scattering from Al (subject to ~20% uncertainty) agreed with prediction.   N. M. B.

Magnetic susceptibility variations of lead oxide. M. PETERSON (Physical Rev., 1938, [ii], **53**, 933).—The red (tetragonal) form of PbO has a const. susceptibility at −0·164 × 10^{-6}, but that of the yellow (orthorhombic) form varies from ∼ −0·164 × 10^{-6} to −0·169 × 10^{-6}. Two forms of orthorhombic crystals appear to exist.   L. S. T.

Changes of electrical resistance due to magnetisation of single crystals of iron and nickel. K. HONDA, T. HIRONE, and N. HORI (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 850—860).—The effect of magnetisation on the electrical resistance of Fe and Ni single crystals is calc. on the basis of Fowler statistics.   L. J. J.

Photo-conductance of dye-sensitised silver bromide and the mechanism of dye-sensitisation. N. KAMEYAMA and K. MIZUTA (J. Soc. Chem. Ind. Japan, 1939, **42**, 426—427B).—The spectral range of photo-conductance of AgBr crystals containing adsorbed erythrosin, indo-, thiocarbo-, and thiocarbo-indo-cyanine is the same as that of their photographic sensitivities. In the range sensitised by the dye electrons are set free or raised to the conductance band by the energy of the light absorbed by the adsorbed dye.   W. A. R.

Nature of the Hall effect. E. WEBER (Physical Rev., 1938, [ii], **53**, 934—935).—It has been shown experimentally that under the simultaneous action of the electric field in the direction of the main current and the magnetic field perpendicular to the current the electron flow is non-uniform, so that the Hall effect is caused by a primary deflexion of the current.   L. S. T.

Interferences from the characteristic radiation of crystals in rotation and powder diagrams. C. FINBACK and O. HASSEL (Avh. norsk. Vidensk.-Akad. Oslo. I. Mat.-nat. Kl., 1937, No. 2, 7 pp.; Chem. Zentr., 1937, i, 3602; cf. A., 1937, I, 152).—Interferences due to radiation from atoms in the lattice are attributed to Einstein's " induced " radiation.

A. J. E. W.

Permeability of iron and nickel for Hertzian waves. K. F. LINDMAN (Z. tech. Physik, 1940, 21, 27—30).—Theoretical. Previous results (A., 1939, I, 555) are not in quant. agreement with the theories of Sommerfeld and Laville (Ann. Physik, 1924, 2, 328). Vals. of the permeability of Fe and Ni calc. from these theories do not agree but in both cases the permeability decreases rapidly for $\lambda\lambda$ <50 cm.

O. D. S.

Paramagnetism. W. J. DE HAAS and J. VAN DEN HANDEL (Comm. Kamerlingh Onnes Lab., 1936, Suppl. 81b, 12 pp.; Chem. Zentr., 1937, i, 3925).—A general report, chiefly on work at low temp. The following topics are discussed with reference to χ data : crystal fields in Dy, Ce, Pr, Nd, and Er Et sulphates; anomalies due to Sm (in Sm_2O_3); paramagnetism in the Fe group (Cr salts and V alum); the magneto-caloric effect in V alum. Cr alum obeys the Curie law with $\Theta = 0$ at $\textless 1\cdot3°$ K. Relaxation times for paramagnetic ions in high-frequency fields are determined (cf. Gorter, A., 1936, 929).

A. J. E. W.

Magnetic studies of co-ordination compounds. I. Cobaltous compounds, with special reference to their resolvability. D. P. MELLOR and R. J. GOLDACRE (J. Proc. Roy. Soc. New South Wales, 1940, 73, 233—239).—Using the Gouy method, the magnetic susceptibilities of $Co(NH_3)_6Cl_2$, [Co en$_3$]Cl$_2$, $Co(C_9H_8N)_2Cl_2,H_2O$, $Na[Co\{C_6H_4(CO_2)_2\}_2],H_2O$, and $(NH_4)_2Co(CNS)_4,4H_2O$ have been measured and the magnetic moments deduced. All are paramagnetic, indicating that Co^{II} forms electrostatic bonds, whereas in the analogous Co^{III} compounds the bonds are covalent. This difference is reflected in the chemical behaviour and stability of the analogues, the Co^{II} members being the less stable, and by the fact that tetrahedral or octahedral complexes of Co^{II} have not been resolved.

W. R. A.

Ultrasonic study of carbon dioxide near its critical point. J. C. HUBBARD and C. M. HERGET (Physical Rev., 1938, [ii], 53, 945).

L. S. T.

Absorption of sound in carbon dioxide and in carbon disulphide. V. O. KNUDSEN and E. FRICKE (Physical Rev., 1938, [ii], 54, 238).—Measurements in pure CO_2 at 1 atm. and 22° confirm the collision theory of anomalous absorption as developed by Einstein, Kneser, and others. The absorption coeff. is appreciable at $\nu\nu$ as low as 2×10^3 cycles, and increases to a max. of 0·317 per λ at 77×10^3 cycles. This indicates that the deformation and symmetrical valency vibrations both take part in the exchanges between vibrational and translational energy. Small amounts of impurity, e.g., H_2O or EtOH, markedly affect absorption, and shift the absorption band to higher $\nu\nu$. Measurements in mixtures of CO_2 in O_2 or in N_2 indicate that neither O_2 nor N_2 is appreciably excited by collisions with CO_2. CS_2 shows an absorption similar to that of CO_2, but beginning at 10^4 cycles. In mixtures of CS_2 and O_2, the absorption observed at <10^4 indicates that only the vibration of O_2 mols. is excited by collisions with CS_2 mols. At higher $\nu\nu$ CS_2 mols. also are excited, mainly by collisions with other CS_2 mols.

L. S. T.

Optical dispersion and molar refraction at zero frequency for compressed nitrogen, argon, and carbon dioxide measured as functions of density. C. E. BENNETT (Physical Rev., 1940, [ii], 58, 263—266; cf. A., 1934, 348).—Data obtained by displacement interferometry are reduced to give the variation of n (at $\lambda = \infty$) with density for pure N_2 for $d = 0\cdot0043$—$0\cdot0165$ g. per c.c. Data for dispersion in A for 0—18 atm. are tabulated, and the Cauchy consts. calc. for n.t.p. are $A_0 - 1 = 0\cdot0002771 \pm0\cdot0000008$, $B_0 = 1\cdot477 \times 10^{-14}$. The Lorentz–Lorenz function, and hence $[R]$ at $\nu = 0$, are independent of density for N_2 and A. $[R]$ for N_2 is $4\cdot369\pm0\cdot003$, and for A $4\cdot138\pm0\cdot012$ c.c. For CO_2 there is evidence of a slight negative deviation from linearity for $(A-1)$ with density, and a marked negative variation of the Lorentz–Lorenz function with density, indicating a decrease in $[R]$ at $\nu = 0$ and suggesting a decrease in the mol. polarisation with density, contrary to the findings of Keyes (cf. Chem. Rev., 1936, 19, 195). The n.t.p. vals. of the Cauchy consts. for CO_2 are : $(A_0 - 1) = 0\cdot0004419\pm0\cdot0000036$, and $B_0 = 2\cdot791 \times 10^{-14}$. The extrapolated $[R]$ at $\nu = 0$ is ~6·65 c.c.

N. M. B.

B.p. of n-alkyl primary amines. A. W. RALSTON, W. M. SELBY, W. O. POOL, and R. H. POTTS (Ind. Eng. Chem., 1940, 32, 1093—1094).—B.p. at various pressures from 1 to 760 mm. are recorded for primary n-alkylamines from C_6 to C_{18}; b.p. apparatus is described. Other physical consts. are recorded for amines and corresponding nitriles. Reciprocals of the b.p. plotted against logarithms of pressures give slightly curved lines, indicating slight association of primary amines in the liquid state.

A. T. P.

B.p.–mol. wt. chart for higher hydrocarbons. D. S. DAVIS (Ind. Eng. Chem., 1940, 32, 1148).—A chart relating the mol. wt., no. of C atoms per mol., and b.p./1 mm. for higher hydrocarbons is given.

J. W. S.

Adiabatic demagnetisation of paramagnetic salts. W. J. DE HAAS and E. C. WIERSMA (Comm. Kamerlingh Onnes Lab., 1936, Suppl. 81c, 12 pp.; Chem. Zentr., 1937, i, 3607).—By the use of a new inductive method the following temp. have been reached by adiabatic demagnetisation of the substances named from a starting temp. of ~1·2° K. : Fe and Cr alums, 0·017° and 0·016°; CeEt(SO$_4$)$_2$, 0·082°; Ti alum and Cr alum diluted 14·4-fold with Al alum, <0·005° K. V alum gives no effect, as its sp. heat at 1·2° K. is too high.

A. J. E. W.

Heat effects of tridymite inversions. A. Q. TOOL (Physical Rev., 1938, [ii], 53, 945—946).—The heat effects in the heating and cooling curves for tridymite obtained by heating SiO_2 gel containing

~1% of $Na_2B_4O_7$ at 950° for six months are described; they may be due to heterogeneity of the crystals.

L. S. T.

Vapour pressure curves of thallium. J. Fischer (Festschr. Tech. Hochschule Breslau, 1910—1935, 172—198; Chem. Zentr., 1937, i, 4208).—The v.p. (p mm.) have been determined by the Knudsen effusion method at ~800—926·7° k., and by the condensation method (in H_2 or A) at 1247—1400° k. At 900—1700° k., log $p = - (45,320/4·571T) - 1·75$ log $T + 14·27$; the effusion method alone gives log $p = - (44,800/4·571T) - 1·75$ log $T + 14·13$. The Trouton const. is 22·6.

A. J. E. W.

Determination of the vapour pressure of solid salts. III. Vapour pressure of TlCl, TlBr, TlI, PbCl$_2$, PbBr$_2$, PbI$_2$, ZnCl$_2$, ZnBr$_2$, ZnI$_2$, CdCl$_2$, CdBr$_2$, and CdI$_2$, and calculation of their thermodynamic values. K. Niwa (J. Fac. Sci. Hokkaido, 1940, [iii], 3, 17—33; cf. A., 1939, I, 311). —V.p. of TlCl (270—360°), TlBr (270—340°), TlI (270—340°), PbCl$_2$ (380—460°), PbBr$_2$ (330—360°), PbI$_2$ (306—377°), ZnCl$_2$ (270—330°), ZnBr$_2$ (240—310°), ZnI$_2$ (220—280°), CdCl$_2$ (370—480°), CdBr$_2$ (320—410°), and CdI$_2$ (260—330°) have been determined by Knudsen's method. Heat of sublimation, mol. energy, chemical const., free energy change, entropy change of sublimation, and entropy of salt-vapour are calc.

A. Li.

Effects of pressure and temperature on the viscosity of monosubstituted toluenes. H. E. Morgan and R. B. Dow (Physical Rev., 1938, [ii], 54, 312).—The η of o-, m-, and p-chloro-, -bromo-, -nitro-, and -iodo-toluene has been determined at 30°, 75°, and 99°, at pressures from atm. to 4000 kg. per sq. cm., by means of the rolling-ball type of high-pressure viscosimeter. The applicability and validity of the log coeff. of η–pressure relation to represent the data are discussed. No general rule for the effect of change of position of the substituted group can be stated. A fundamental difference in the vibration of the PhMe ring when the substituent is in the p-position is indicated.

L. S. T.

Theory of the thermal diffusion coefficient for isotopes. R. C. Jones (Physical Rev., 1940, [ii], 58, 111—122; cf. A., 1940, I, 230).—Mathematical. The first approximation to the thermal diffusion const. α of a mixture of two isotopes is derived from Enskog's theory of thermal diffusion. The general formula for α is worked out explicitly for the elastic sphere, inverse power, Sutherland, and Lennard-Jones models and results are compared with available experimental data. The validity of mol. models of kinetic theory is examined critically.

N. M. B.

Strains produced by precipitation in alloys. F. R. N. Nabarro (Proc. Roy. Soc., 1940, A, 175, 519—538).—The strain set up in an alloy when a new phase is in process of pptn. is investigated theoretically. The energy involved is calc. for a variety of different shapes of pptd. particle, and is least for thin plates. The calc. shape agrees with that observed experimentally.

G. D. P.

Vapour pressures and b.p. of binary mixtures of hydrogen peroxide and water. P. A. Giguère

and O. Maass (Canad. J. Res., 1940, 18, B, 181—193).—The v.p. of H_2O_2–H_2O mixtures and the compositions of their saturated vapours have been measured at 30°, 45°, and 60°, and over the entire concn. range. The heats of vaporisation and the normal b.p. of the solutions are deduced. The total v.p.–composition curves show large negative deviations from Raoult's law, but have no min. The partial pressures of the components and their activities in the solutions are calc. These can be explained from the polar nature of the liquids.

J. W. S.

Accumulation of sulphur dioxide in sodium phosphate solutions. G. P. Lutschinski and R. M. Tavrovskaja (J. Appl. Chem. Russ., 1940, 13, 421—427).—The solubility of SO_2 in aq. Na_2HPO_4 is $\propto$ concn. The partial SO_2 and H_2O pressures above the solutions are $\propto$ [SO_2] and [H_2O]. Dissolved SO_2 is quantitatively eliminated by boiling the solutions.

R. T.

Absorption of gases by a drop of liquid. K. Schabalin (J. Appl. Chem. Russ., 1940, 13, 412—420).—The velocity of absorption of NH_3 by a falling drop of H_2O is $\propto$ duration of contact, and inversely $\propto$ diameter of the drop; it is in general determined by the resistance of the absorption film. The same considerations apply to absorption of CO_2, except that in this case convection currents within the drop are of importance. Such currents are practically absent from very small droplets, for which reason a certain optimum drop diameter should exist for each gas, depending on its solubility.

R. T.

Interferometer method for measuring absolute adsorption in surface of solutions. J. W. McBain, G. F. Mills, and T. F. Ford (Trans. Faraday Soc., 1940, 36, 930—935).—The method previously reported (A., 1936, 423) is described in detail and used to measure the adsorption of Ph·[CH$_2$]$_2$·CO$_2$H and $C_{12}H_{25}$·SO$_3$H at the air–solution interface. The results agree fairly with the predictions of the Gibbs theorem.

F. L. U.

Changes in viscosity of agar sol with concentration. S. N. Banerji and S. Ghosh (Proc. Nat. Acad. Sci. India, 1939, 9, 144—147).—1% agar sol kept for 6—8 min. in contact with a small piece of ready-formed gel of the same concn. shows a large increase in η compared with a similar untreated sol. The effect is greater at 40° than at 50°. The η–concn. relation of agar sols cannot be represented by the formulæ of Arrhenius, Hess, or Hatschek. The rapid increase of η with concn. is attributed to increase in rigidity and in the relaxation time rather than to high solvation.

F. L. U.

Changes in viscosity of agar sol with temperature. S. N. Banerji and S. Ghosh (Proc. Nat. Acad. Sci. India, 1939, 9, 148—153).—The η of agar sol has been measured for different concn. and temp. The results are in accord with Madge's formula. The high temp. coeff. is interpreted on the assumption of rigidity caused by quasi-cryst. orientation of the micelles.

F. L. U.

Hevea latex. **Effect of proteins and electrolytes on colloidal behaviour.**—See A., 1940, III, 764.

Periodic precipitation in absence of foreign gel. III. Ferric phosphate and ferric arsenate sols. IV. Ferric borate sol. R. N. MITTRA (Proc. Nat. Acad. Sci. India, 1939, 9, 131—137, 138—143).—III. Sols of $FePO_4$ and $FeAsO_4$ produce rings when coagulated with suitable amounts of K_2SO_4. Data for the speed of coagulation are recorded.

IV. Fe^{III} borate sol also shows ring formation with K_2SO_4. Details are given. The effect in all three sols is governed, as in the $Fe(OH)_3$ sols previously studied (cf. A., 1939, I, 417), by the speed of coagulation, the vol. of ppt., and adsorption of sol by the coagulum.   F. L. U.

Thermal transpiration of a dissociating gas. B. N. SRIVASTAVA (Proc. Roy. Soc., 1940, A, 175, 474—483).—The thermal transpiration of a dissociating gas is investigated theoretically for two chambers at different temp. joined by a narrow opening. The condition of thermodynamic equilibrium and the usual transpiration relation for each constituent cannot be satisfied. Rigorous and approx. solutions of the problem are obtained.   G. D. P.

Concentration of cations at negatively-charged surfaces. D. A. WEBB and J. F. DANIELLI (Nature, 1940, 146, 197—198).—The p_H at the surface of cetyl sulphate micelles calc. from the Gibbs–Donnan equilibrium agrees with vals. obtained by other methods (cf. A., 1940, I, 110). Chemical analysis of palmitate monolayers spread on solutions containing different concns. of $Na^.$ and $Ca^{..}$ shows that, as predicted by this equilibrium, the $Na^.$: $Ca^{..}$ ratio in the surface is < that in the bulk, but is ≪ the predicted val. This indicates that $Ca^{..}$ is bound at the interface by forces additional to electrostatic attraction. The negatively-charged surfaces act as reservoirs of bivalent ions, and their discharge or dissolution releases a disproportionate amount of bivalent ions.   L. S. T.

Minimum and equilibrium concentrations. I. A. M. BELOUSOV and A. P. TERENTIEVA (J. Appl. Chem. Russ., 1940, 13, 463—469).—The min. [$Ba^{..}$] at which turbidity is observed in presence of SO_4'' is expressed by $C_{min.} = \beta L_p/[SO_4'']$, where L_p is the solubility product of $BaSO_4$, and β is a const., ∼10^4.   R. T.

Complex formation in the system $PbCl_2$–NaCl–H_2O. B. V. GROMOV (J. Appl. Chem. Russ., 1940, 13, 337—344).—Formation of double compounds was not observed.   R. T.

Heat of dissociation and specific heats of ammonium phosphates and atomic heat of nitrogen. S. SATOH and T. SOGABE (Bull. Inst. Phys. Chem. Res. Japan, 1940, 19, 861—867).—For $NH_4H_2PO_4$, $(NH_4)_3H_3P_2O_8$, and $(NH_4)_2HPO_4$ between 0° and 99·6°, $c = 0·3089$, 0·3309, and 0·3408, respectively. From the mol. heats of the first and last-named, the at. heat of N = 2·27. These vals. give for the heat of dissociation of $(NH_4)_2HPO_4 \rightarrow NH_4H_2PO_4 + NH_3 - 18·5_5$ kg.-cal., using the dissociation pressure measured at high temp.   L. J. J.

Equilibria in the system $PbSO_4$–NaCl–H_2O. B. V. GROMOV (J. Appl. Chem. Russ., 1940, 13, 345—356).—In the reciprocal system $PbSO_4 + 2NaCl \rightleftharpoons PbCl_2 + Na_2SO_4$, in H_2O at 25—100°, the stable salts are $PbSO_4$ and NaCl, no other solid phases being formed.   R. T.

Effect of the " basic " electrolyte on the polarographic wave of cadmium and lead. S. P. SCHAIKIND (J. Appl. Chem. Russ., 1940, 13, 455—462).—The height h of the wave is ∝ concn. over the range 2·5—125 mg. of $Cd^{..}$ per l. in aq. KCl, Na_2SO_4, $ZnCl_2$, or $ZnSO_4$, or 20—300 mg. of $Pb^{..}$ per l. in KCl or $ZnCl_2$. Varying the [KCl] from 0·1 to 2M. does not affect the results, whilst in aq. $ZnCl_2$ or $ZnSO_4$ h is ∝ 1/[$Zn^{..}$]. For Cd, h falls in the series KCl, $ZnCl_2$, $ZnSO_4$, and for Pb in the order $Zn^{..}$, $K^.$. In the polarographic determination of Cd and Pb in Zn, the concn. of the accompanying electrolytes in the standard solution should equal that in the test solution.   R. T.

Ignition and ignitibility. H. C. PORTER (Ind. Eng. Chem., 1940, 32, 1034—1036).—The relative ease of ignition of various substances has been compared by determining the current required to be passed through a heater element to cause ignition of the material, enclosed in a bomb under a moderate pressure of O_2, with the heater applied at one point of the material only. The % combustion occurring within 2 min. after ignition is also recorded. Compounds with open-chain structure, or materials containing ingredients with such structure (humic substances or lignin), are more easily ignited than substances containing ring structures.   J. W. S.

Explosive properties of *cyclo*propane.—See B., 1940, 653.

Kinetics of the inhibition of the reaction between chlorine and nitric oxide. E. M. STODDART (J.C.S., 1940, 823—831).—The velocity of reaction between Cl_2 and NO does not follow a termol. reaction law, but is affected by surface conditions. The NOCl formed appears to be adsorbed slowly on the surface, thereby inhibiting the surface reaction until it stops completely. It is supposed that the complex mol. $(NO)_2$ is formed in heterogeneous equilibrium with NO, dissociation being almost complete, and that when the $(NO)_2$ mol. is formed on the active surface it is capable of reaction with Cl_2, whereas when formed on an inactive surface it is incapable of reaction. Therefore the total no. of complex mols. is independent of the surface area of the reaction vessel, and the observation of previous workers that the reaction follows a termol. law is attributed to their using surfaces which prevented inhibition. The inhibition and final stoppage of the reaction observed with glass reaction vessels are attributed to slow adsorption of NOCl on the active surface.   J. W. S.

Mechanism of elimination reactions. V. Kinetics of olefine elimination from ethyl, *iso*propyl, *tert*.-butyl, and α- and β-phenylethyl bromides in acidic and in alkaline alcoholic solution. Effects due to, and factors influencing, the two mechanisms of elimination. E. D. HUGHES, C. K. INGOLD, S. MASTERMAN, and B. J. MCNULTY (J.C.S., 1940, 899—912; cf. A., 1937, I, 467).—Taylor's method of determining the proportions of olefine formed from alkyl halides (A., 1938, II, 37) leads to considerable errors when volatile

olefines are handled. Some of the reactions studied by Taylor do not proceed at appreciable rates at the temp. used. Studies of the reaction kinetics of the elimination of HBr (with NaOEt) from EtBr, Pr$^\beta$Br, Bu$^\gamma$Br, CHPhMeBr, and Ph·[CH$_2$]$_2$·Br confirm the existence of parallel first- and second-order reactions, and the velocity coeffs. of these constituent reactions are derived. The effects of the structure of the mol., the nature of the solvent, and the concns. in the solution are discussed.   J. W. S.

Mechanism of substitution at a saturated carbon atom. XI. Hydrolysis of *tert.*-butyl bromide in acidic moist acetone. L. C. BATEMAN, K. A. COOPER, and E. D. HUGHES. **XII. Hydrolysis of benzhydryl chloride in acidic moist acetone.** M. G. CHURCH and E. D. HUGHES. **XIII. Mechanisms operative in the hydrolysis of methyl, ethyl, *iso*propyl, and *tert.*-butyl bromides in aqueous solutions.** L. C. BATEMAN, K. A. COOPER, E. D. HUGHES, and C. K. INGOLD. **XIV. Unimolecular substitutions of *tert.*-butyl chloride with water, and with anions, as substituting agents in formic acid solution.** L. C. BATEMAN and E. D. HUGHES. **XV. Unimolecular and bimolecular substitutions of *n*-butyl bromide with water, and with anions, as substituting agents in formic acid solution.** L. C. BATEMAN and E. D. HUGHES. **XVI. Hydrolysis of methyl, ethyl, *iso*propyl, and *tert.*-butyl bromides in acidic solutions under conditions believed to be conducive to uniformity of mechanism.** L. C. BATEMAN and E. D. HUGHES. **XVII. Polar effects in alkyl groups as illustrated by solvolytic substitutions of *p*-alkylbenzhydryl chlorides.** E. D. HUGHES, C. K. INGOLD, and N. A. TAHER. **XVIII. Polar effect of the carboxylate ion group as illustrated by the hydrolysis of the bromomalonate and α-bromomethylmalonate ions.** E. D. HUGHES and N. A. TAHER. **XIX. Kinetic demonstration of the unimolecular solvolysis of alkyl halides. A. Kinetics of, and salt effects in, the hydrolysis of *tert.*-butyl bromide in aqueous acetone.** L. C. BATEMAN, E. D. HUGHES, and C. K. INGOLD. **XX. Kinetic demonstration of the unimolecular solvolysis of alkyl halides. B. Kinetics of, and salt effects in, the hydrolysis of benzhydryl halides in aqueous acetone.** M. G. CHURCH, E. D. HUGHES, and C. K. INGOLD. **XXI. Kinetic demonstration of the unimolecular solvolysis of alkyl halides. C. Kinetics of, and salt effects in, the hydrolysis of *p*-monoalkylbenzhydryl halides in aqueous acetone.** M. G. CHURCH, E. D. HUGHES, C. K. INGOLD, and N. A. TAHER. **XXII. Kinetic demonstration of the unimolecular solvolysis of alkyl halides. D. Kinetics of, and salt effects in, the hydrolysis of *pp'*-dimethylbenzhydryl chloride in aqueous acetone.** L. C. BATEMAN, E. D. HUGHES, and C. K. INGOLD. **XXIII. Kinetic demonstration of the unimolecular solvolysis of alkyl halides. E. General discussion.** L. C. BATEMAN, M. G. CHURCH, E. D. HUGHES, C. K. INGOLD, and N. A. TAHER. **XXIV. Qualitative survey of nucleophilic substitutions of benzhydryl halides in**

sulphur dioxide solution. L. C. BATEMAN, E. D. HUGHES, and C. K. INGOLD. **XXV. Unimolecular halogen exchange between an alkyl halide and halide ions in sulphur dioxide solution, and a concluding note.** L. C. BATEMAN, E. D. HUGHES, and C. K. INGOLD (J.C.S., 1940, 913—920, 920—925, 925—935, 935—940, 940—944, 945—948, 949—956, 956—960, 960—966, 966—970, 971—974, 974—978, 979—1011, 1011—1017, 1017—1029; cf. A., 1938, II, 304).—XI. The assumption of Taylor (A., 1938, I, 86) that in moist COMe$_2$ Bu$^\gamma$Br reacts with H$_2$O reversibly, Bu$^\gamma$Br + H$_2$O $\rightleftharpoons$ Bu$^\gamma$OH + HBr, is incorrect, whilst the method of calculation leading to his finding of agreement between observed equilibrium concns. and those calc. for rate consts. is based on false premises. Taylor's observation of approx. identity of the second-order velocity coeffs. for the hydrolysis in COMe$_2$ containing 1 and 2 vol.-% of H$_2$O is valueless as evidence of a bimol. reaction, as proportionality is to be expected from the unimol. mechanism, when there is no stoicheiometric intervention by H$_2$O in the rate-measured process.

XII. The equilibrium supposed by Taylor (*ibid.*, 627) to exist in the hydrolysis of CHPh$_2$Cl is shown to be non-existent and his calculation of the equilibrium composition is incorrect. His interpretation of the variation of reaction velocity with H$_2$O content is contrary to thermodynamics.

XIII. Taylor's views (A., 1937, I, 417; 1938, I, 404; 1940, I, 77) are criticised. It is emphasised that the variation of the velocity of hydrolysis of the bromides is associated with the difference in the mechanism of substitution, the S$_N$2 form following the order Me>Et>Pr$^\beta$>Bu$^\gamma$, and the S$_N$1 mechanism following the reverse order. The theory is supported by additional data for the hydrolysis in alkaline aq. EtOH and in aq. COMe$_2$, when the reactions are of the second and of the first order, respectively.

XIV. It is shown that HCO$_2$Bu$^\gamma$ cannot be isolated in quantity from the products of interaction of HCO$_2$H and Bu$^\gamma$Cl at room temp., and the results of Taylor (A., 1938, II, 40) are attributed to his using a large excess of (HCO$_2$)$_2$Ca. Addition of (CH$_2$Cl·CO$_2$)$_2$Ca similarly yields CH$_2$Cl·CO$_2$Bu$^\gamma$. These substitutions are unimol., the anions intervening only after the slow and rate-controlling ionisation of the Bu$^\gamma$Cl.

XV. The rate of interaction of Bu$^\alpha$Br in HCO$_2$H containing H$_2$O increases linearly with the [H$_2$O], indicating that the reaction is predominantly bimol., whereas the corresponding reaction with Bu$^\gamma$Cl is unimol. HCO$_2'$ ions accelerate the reaction considerably, indicating that in this case direct attack on the Bu$^\alpha$Br mol. occurs.

XVI. The reactivities of the alkyl bromides during their hydrolysis in wet HCO$_2$H follow the order predicted previously for the unimol. (S$_N$1) reaction, viz., Me < Et < Pr$^\beta$ < Bu$^\gamma$. The effects of increasing the [H$_2$O] indicate that the bimol. mechanism increases in importance from Bu$^\gamma$ to Me, but is insufficient to produce a rate min., such as is observed in wet COMe$_2$.

XVII. The rates of hydrolysis and alcoholysis of CHPh$_2$Cl and its *p*-alkyl derivatives have been determined, and the energies of activation are derived. The rates of reaction of the *p*-derivatives accord with

the order of electron release sequence, viz., Me $>$ Et $>$ Pr^{β} $>$ Bu^{γ} $>$ H, thereby demonstrating the reality of the tautomeric displacements of the electrons of the non-ionisable CH groups. That the CH groups do not ionise is confirmed by isotopic indicator tests.

XVIII. The hydrolysis of $CHBr(CO_2Na)_2$ and $CMeBr(CO_2Na)_2$ in dil. NaOH proceeds by a unimol. (S_N1) mechanism. The results are correlated with analogous data for alkyl bromides and the Br-derivatives of fatty acids.

XIX. The initial velocity of hydrolysis of $Bu^{\gamma}Br$ in 70% and 90% aq. $COMe_2$ at 50° is increased by ~1·4 times when the solution is made ~0·1м. in LiBr, LiCl, or NaN_3.

XX. Addition of HCl, LiCl, NaCl, LiBr, or NaN_3 increases the velocity of hydrolysis of $CHPh_2Cl$ and $CHPh_2Br$ in 80% and 90% aq. $COMe_2$, but the special retarding effect of the anions, associated with the unimol. mechanism, is also increased, with the result that under certain conditions this determines the qual. results.

XXI. The hydrolysis of p-$C_6H_4Bu^{\gamma}$·$CHPhCl$ and p-C_6H_4Me·$CHPhCl$ in aq. $COMe_2$, alone and in the presence of HCl, NaCl, LiBr, or NaN_3, shows considerable deviation from first-order kinetics. The results are interpreted as indicating that although the accelerating electrostatic effect of electrolytes in general with these compounds is $>$ with $CHPh_2Cl$ the retarding mass law effect is much greater and therefore controls the reaction velocity.

XXII. The hydrolysis of $CHCl(C_6H_4Me$-$p)_2$ (I) in 50—90% aq. $COMe_2$ shows no relation to first-order kinetics. Addition of LiCl decreases the velocity of reaction, whilst LiBr, NaN_3, and NMe_4·NO_3 increase it. The effects are attributed to a very large mass effect, arising from the unimol. mechanism. In the presence of NaN_3 the extent of formation of $CHN_3(C_6H_4Me$-$p)_2$ is independent of the [(I)] and [H_2O] but dependent on the [N_3'].

XXIII. Evidence that these reactions are unimol. is summarised, and the kinetics of the various stages of the reactions are discussed in detail.

XXIV. The interactions of $CHPh_2Cl$ and m-C_6H_4Cl·$CHPhCl$ with NEt_4F, NMe_4F, C_5H_5N, NEt_3, and H_2O in liquid SO_2 occur at rates which are initially of the same order, indicating that these reactions are unimol., involving initial ionisation of the chlorides.

XXV. The reaction of m-C_6H_4Cl·$CHPhCl$ with F′ and I′ in liquid SO_2 follows neither first- nor second-order laws. From a study of the variation of the initial reaction velocity with [F′] it is shown that the ionic strength effect is unusually large, an ionic strength of 0·05 trebling the velocity. The mass law effect is also very large, and controls the course of the substitution reaction, owing to the gradual development of Cl′ in solution. The results are in quant. accord with theory.   J. W. S.

Kinetics of thermal decomposition of calcium carbonate. G. F. HÜTTIG and H. KAPPEL (Angew. Chem., 1940, **53**, 57—59).—Arrangements whereby the spatial distribution of reaction in the thermal decomp. of a mass of powdered $CaCO_3$ has been studied are described. In the surface layers there is a rapid decomp. of the first order. In the interior

layers the decomp. is slower and of zero order. Between these zones there are regions where the reaction is of intermediate character, with apparently fractional orders. In the surface layers the decomp. itself is the determining factor, but in the inner layers diffusion and thermal conduction play a controlling part.   F. J. G.

Reduction of barium oxide by metals at high temperature. J. P. BLEWETT (Physical Rev., 1938, [ii], **53**, 935).—The rate of evolution of Ba from mixtures of BaO with Ti, Ni, or Mo has been measured.   L. S. T.

Catalytic isotope exchange of gaseous oxygen. IX. Preparation and catalytic activity of catalyst. Mixed catalytic action of impurities. N. MORITA (Bull. Chem. Soc. Japan, 1940, **15**, 226—234; cf. A., 1939, I, 87).—The exchange of O isotopes between O_2 and H_2O vapour in contact with CuO is little affected by varying either the physical condition of the CuO or its method of prep. CuO that has been soaked in dil. aq. NaOH and dried so as to contain $>$0·2% of NaOH shows enhanced catalytic activity. Pumice, by itself inactive, becomes active when containing a little NaOH, but its activity is still $<$ that of untreated CuO.   F. L. U.

[**Catalytic**] **synthesis of benzine.**—See B., 1940, 653, 654.

[**Catalytic**] **preparation of butadiene.**—See B., 1940, 657.

Activation of hæmatite.—See B., 1940, 667.

Influence of impurities on velocity of dissolution of zinc in sulphuric acid.—See B., 1940, 673.

Cryolite and electrolytic process of aluminium production.—See B., 1940, 675.

Photographic reversal. S. E. SHEPPARD (Physical Rev., 1940, [ii], **58**, 93; cf. Nafe, B., 1940, 702).—A brief discussion of the theory of reversal.   N. M. B.

Quantum yield in chloroacetic acid. L. B. THOMAS (J. Amer. Chem. Soc., 1940, **62**, 1879—1880).—The quantum yield at 25° in CH_2Cl·CO_2H for λ 2537 is 0·342, confirming the val. given by Smith *et al.* (A., 1939, I, 573).   F. J. G.

Separation of radioactive substances without the use of a carrier. D. C. GRAHAME and G. T. SEABORG (Physical Rev., 1938, [ii], **54**, 240—241).—Radioactive Ga chloride, obtained from Ga-free Zn bombarded with 8-Me.v. deuterons, can be extracted by Et_2O from the 6n-HCl solution without addition of inactive Ga chloride as carrier. The partition coeffs. between the liquid phases for the chlorides of ^{68}Ga (1 hr.) and ^{67}Ga (83 hr.) are identical with those observed for Ga chloride in ordinary amounts. Extraction methods provide a simple means of separating completely and in the most conc. form the radioactive isotopes of many elements.   L. S. T.

Separation of rare earths by electrolytic hydrolysis of their azides. J. ANT-WUORINEN (Suomen Kem., 1940, **13**, B, 1—3).—The mixture of rare-earth hydroxides is dissolved in aq. HN_3, and the solution fractionally hydrolysed by electrolysis in a diaphragm

cell, moving Pt electrodes and a c.d. of 0·05 amp. per sq. cm. being used. Results are given.

M. H. M. A.

Formation of double fluorides of thallium with fluorides of quinquevalent metalloids and metals of the nitrogen group. J. Ant-Wuorinen (Suomen Kem., 1940, **13, B**, 3—4).—Dissolution of the appropriate oxide in HF and addition of TlF gives $TlMF_6$ (M = V, Nb, Sb). The Bi compound could not be obtained. AsF_5 and TlF give probably $TlAsF_6$. All the compounds are very unstable.

M. H. M. A.

Fundamentals and calculation of a new physiochemical method for determination of individual constituents of mixtures. L. Ebert (Angew. Chem., 1940, **53**, 128—129; cf. Ibing, A., 1940, II, 318).—Improved derivations and simplified formulæ are given.

F. J. G.

Physico-chemical determination of components in mixtures.—See A., 1940, II, 318.

Stable 2 : 6-dichlorobenzenone-indophenol solutions. I. Stone (Ind. Eng. Chem. [Anal.], 1940, **12**, 415).—Solutions of Na 2:6-dichlorobenzenone-indophenol in dioxan acidified with AcOH are stable for several months.

J. D. R.

Sensitive method for determination of moisture.—See B., 1940, 678.

Photo-mechanical method for the determination of atmospheric ozone. B. O'Brien and H. S. Stewart, jun. (Physical Rev., 1938, [ii], **53**, 949).— A photographic method for continuous determination of atm. O_3 from ultra-violet solar spectra of wedge form recorded serially on a film has been developed.

L. S. T.

Determination of pyrites and total sulphur in bituminous coal.—See B., 1940, 652.

Sensitivity of Nessler's solution. K. Suzuki (J. Soc. Chem. Ind. Japan, 1939, **42**, 375B).—Nessler's solution is the more sensitive, the lower is the [KI]. Small amounts of HCl do not interfere, but in presence of high concns. the solution becomes quite insensitive.

W. A. R.

Group separation for the quantitative and qualitative analysis of phosphates. G. J. Austin (Analyst, 1940, **65**, 335—347).—Groups I and II are removed as usual. Ba and Sr are pptd. as sulphates from a solution ~0·2N. with respect to HCl. Fe, Al, and Cr are pptd. as phosphates at p_H 3·2—3·4. Zn, Ni, and Co are pptd. by buffering the solution to p_H 4·6—4·8 and passing H_2S. The H_2S is boiled off; Mn is oxidised with NaOCl and pptd. as MnO_2. Ca is pptd. as oxalate. The solution is then made ammoniacal and Mg pptd. as phosphate. Na and K are tested for separately. Tables of the quant. adsorption of metals of the Fe-group phosphates indicate that the method compares well with the basic acetate method in this respect. E. C. B. S.

Quantitative analysis by X-ray diffraction. I. Determination of quartz. J. W. Ballard, H. I. Oshry, and H. H. Schrenk (U.S. Bur. Mines, Rept. Invest. 3520, 1940, 10 pp.).—The application of X-ray diffraction to the determination of the SiO_2 content of dusts is described. The internal standard method is used, the standards being known mixtures of SiO_2 and calcite with a const. proportion of fluorite. Results of tests with various dusts of known SiO_2 content indicate that the average error is ~7% when $[SiO_2]$ is > ~3%; with lower $[SiO_2]$ the error is somewhat greater. C. R. H.

[Detection of] silicon in steel.—See B., 1940, 673.

Determination of carbon disulphide in air.— See B., 1940, 707.

Determination of the radon and thoron content of air. C. Goodman and R. D. Evans (Physical Rev., 1938, [ii], **54**, 866).—A method of sampling and collection from air is described. Ordinary laboratory air contains $<10^{-13}$ Curie of Rn or thoron per l. The Rn content of air in Ra-dial painting plants varies from 4×10^{-12} to 25×10^{-12} Curie per l. The thoron content of air in Th-mantle factories ranges from 250×10^{-12} to 4400×10^{-12} Curie per l.

L. S. T.

Old and new systems for reporting the inorganic constituents in natural waters. V. G. Anderson (J. Proc. Austral. Chem. Inst., 1940, **7**, 187—212).—Two rational numerical bases of reporting results are suggested. In one, each radical in the total dry saline matter is expressed as a-%. In the other the results are expressed as ratios taking 100 equivs. of Cl' as reference no. The limitation of these methods, which facilitate interpretation and classification, are indicated. For graphical interpretation of the analytical results polar charts, compound bar charts, or the perimetric diagram can be used. In the perimetric diagram, the mg.-equiv. concns. of Cl, SO_4, NO_3, and HCO_3 are represented by four straight lines, relatively inclined to each other and placed end to end to form half of the perimeter of the parallel solid figure, and the basic radicals along the semiperimeter of the remaining half of the figure; the HCO_3 radical is drawn horizontally to the remainder. The magnitudes are represented by lines, not areas. The shape of the diagram indicates the type of H_2O, the nature and probable origin of the dissolved salts, and composition of the probable product of evaporation. Application of these numerical and graphical methods shows that the composition of dissolved mineral matter in many Australian waters is closely related to that of sea-H_2O. O. M.

Colorimetric determination of copper with triethanolamine. J. H. Yoe and C. J. Barton (Ind. Eng. Chem. [Anal.], 1940, **12**, 456—459).— The colorimetric determination of Cu with $N([CH_2]_2 \cdot OH)_3$ (I) has been investigated spectrophotometrically, and compared with the Cu–NH_3 method. The effects of concn. of the reagent and of NH_4, Na, and K salts on the transmission at 625 mμ. of a solution containing 100 p.p.m. of Cu·· are shown graphically. Beer's law holds for Cu–NH_3 systems at 625 mμ. over a range of 0—1000 p.p.m. of Cu·· for 0·3 and 2·5M-NH_3, but not for the Cu–(I) solutions over the entire useful range of [Cu··]. The (I) method is slightly the more sensitive at low [Cu··], and has the advantages of no odour, no loss of reagent by volatilisation, and a small reagent concn. effect.

L. S. T.

Rapid determination of copper in ferromolybdenum, calcium molybdate, etc. by α-benzoinoxime.—See B., 1940, 673.

Determination of manganese in organic material containing large amounts of calcium and chlorides.—See A., 1940, III, 780.

Weathering of igneous rocks. VII. Determination of free iron oxide. M. HARADA (J. Agric. Chem. Soc. Japan, 1940, **16**, 541—551; cf. A., 1940, I, 333).—Limonitic and hæmatitic Fe_2O_3 slowly dissolve under the influence of light in dil. aq. $H_2C_2O_4$–$K_2C_2O_4$. At first a very small amount of Fe_2O_3 dissolves and forms $K_3Fe(C_2O_4)_3$, which is then converted photochemically into $K_2Fe(C_2O_4)_2$. The latter acts as a catalyst for the dissolution of further Fe_2O_3, the reaction taking place in violet and ultraviolet light, or in the dark on warming. Methods, based on the above reactions, for the determination of free, limonitic and non-limonitic, hæmatitic and non-hæmatitic Fe_2O_3 in various earths are described.
J. N. A.

Colorimetric determination of iron with salicylaldoxime. D. E. HOWE [with M. G. MELLON] (Ind. Eng. Chem. [Anal.], 1940, **12**, 448—450).—The coloured complex formed between $Fe^{...}$ and salicylaldoxime has been investigated spectrophotometrically, and shown to be suitable for colorimetric determination of 0·05—10 p.p.m. of $Fe^{...}$. Control of p_H is essential, and determinations are best effected at p_H 7 (NH_4OAc buffer). At this p_H, Beer's law holds over a wide concn. range, and the red-orange colour develops to a max. in 30 sec. and is stable for >24 hr. In a 30-cm. Nessler tube, the smallest amount of $Fe^{...}$ detectable is 1 in 2×10^7 parts of solution. The coloured complex is not extractable from the aq. solution by EtOH, CS_2, C_6H_6, or EtOAc, and only slightly by $CHCl_3$. Cl', Br', CNS', ClO_3', ClO_4', SO_4'', and OAc' do not interfere, but tartrate, citrate, C_2O_4'', CN', CO_3'', BO_3''', PO_4'''', and excessive amounts of F' must be absent. Colourless cations do not interfere. Details of procedure are given.
L. S. T.

Identification of ferrocyanide ion. W. C. OELKE (Ind. Eng. Chem. [Anal.], 1940, **12**, 498).—To 1 drop of the test solution are added dil. HCl and 1 drop of 10% $TiCl_4$ in 1 : 1 HCl. A yellowish- or reddish-brown ppt. indicates the presence of $Fe(CN)_6''''$. $Fe(CN)_6'''$ gives no ppt. NO_2', AsO_4''', CrO_4'', and other strongly oxidising ions interfere. The limit of sensitivity is 0·05 mg. of $Fe(CN)_6''''$. L. S. T.

Colorimetric determination of cobalt with β-nitroso-α-naphthol. J. H. YOE and C. J. BARTON (Ind. Eng. Chem. [Anal.], 1940, **12**, 405—409).—The optimum conditions of measurement, the effects of salts, and the interferences due to relatively large amounts of $Ni^{..}$, $Cu^{..}$, $Fe^{...}$, $Cr^{...}$, and $Mn^{..}$ have been determined by a spectrophotometric investigation of the method. The chief advantages are high sensitivity and reproducibility, and the disadvantages are the large effect of $[NH_3]$ and the low solubility of the Co compound. For 1 p.p.m. of $Co^{..}$, the probable error of the method is ±0·006 p.p.m. of $Co^{..}$. The Lambert–Beer law holds for concns. of 0—1·0 p.p.m. 1 : 2-NO-$C_{10}H_6$·OH has approx. the same sensitivity, 0·005 p.p.m. (cf. A., 1920, ii, 194) as the 2 : 1-compound, and is subject to the same limitations. L. S. T.

Nitroso-R-salt method for determination of cobalt in pastures.—See B., 1940, 699.

Separation of molybdenum from tin and sulphur. D. A. LAMBIE and W. R. SCHOELLER (Analyst, 1940, **65**, 281—286).—The quant. separation of Mo as MoS from aq.-$H_2C_2O_4$ solutions containing Sn salts was unsuccessful. The MoS ppt. carried down appreciable quantities of Sn, which interfered with its subsequent determination as $PbMoO_4$. By careful definition of the conditions, separation of Sn from Mo was achieved by co-pptn. of $Sn(OH)_4$ with $Fe(OH)_3$. The boiling solution of Mo and Sn (total wt. <0·3 g.) in HCl (10 ml.) and HNO_3 (3 ml.) was treated with $FeCl_3$, diluted, and poured into hot aq. NH_3 (100 ml.). The ppt. was redissolved in HCl and the procedure repeated. The Sn is best determined as SnS_2 with subsequent ignition to SnO_2. $BaSO_4$ pptd. in the presence of MoO_4'' is heavily contaminated; Mo must be removed before determination of SO_4''. A successful procedure is described; the MoO_4'' is pptd. as $PbMoO_4$ in presence of NH_4OAc and NH_4Cl, the SO_4'' being determined in the usual way in the filtrates. E. C. B. S.

Radiation pyrometer for the measurement of low and high temperatures. J. STRONG (Physical Rev., 1938, [ii], **54**, 242).—The instrument described can be used to measure the surface temp. of solids, gases, vapours, liquids, and clouds. L. S. T.

High-pressure arc as spectroscopic source. W. W. WATSON (Physical Rev., 1938, [ii], **54**, 865).—A new high-pressure spectrum of PbH has been obtained as an example of the enhancement of the population of many discrete excited states of mols. that results when gas pressure is increased to several atm. L. S. T.

Thin quartz crystals as used in the Cauchois focussing X-ray spectrograph. F. R. HIRSH, jun. (Physical Rev., 1940, [ii], **58**, 78—81; cf. A., 1939, I, 64).—A discussion of the origin and characteristics of doubled X-ray lines formed by the Cauchois focussing spectrograph. N. M. B.

Automatic spectrograph and accessory equipment for solar spectrum photography. H. S. STEWART, jun., and B. O'BRIEN (Physical Rev., 1938, [ii], **53**, 949).—An automatic quartz spectrograph recording the ultra-violet solar spectrum on a film has been constructed. L. S. T.

Refractive indices of cellulose film. I. Determination of refractive indices of mica as a model of the cellulose film with Abbé refractometer. S. OKAJIMA (J. Soc. Chem. Ind. Japan, 1939, **42**, 381—382B).—The refractive indices of mica can be accurately determined with an Abbé refractometer, using mixtures of PhI, $CH_2Ph·OBz$, and $CH_2Ph·OH$ as immersion liquids. The vals. are independent of those of the immersion liquids. W. A. R.

New electron microscope. L. MARTON (Physical Rev., 1940, [ii], **58**, 57—60).—A high-power, self-

contained instrument of the transmission type, giving a resolving power of ~50 a., is described. N. M. B.

Electron microscope for the research laboratory. V. K. ZWORYKIN (Science, 1940, **92**, 51—53).—The main features of the microscope are described and illustrated. Photographs of pathogenic bacteria obtained with it are reproduced. L. S. T.

Vacuum-tube voltmeter. Application to potentiometric precipitation titrations. L. E. WEST and R. J. ROBINSON (Ind. Eng. Chem. [Anal.], 1940, **12**, 476—479).—The modification of the Kinney-Garman (A., 1936, 955) apparatus described permits its extension to the titration of Cl' with Ag·, SO_4'' with Ba··, and Mg·· with OH'. L. S. T.

Universal p_H meter and simplified vacuum-tube electrometer. F. M. GOYAN, C. L. BARNES, and H. W. HIND (Ind. Eng. Chem. [Anal.], 1940, **12**, 485—488).—A circuit capable of transforming a potentiometer and standard cell into a direct-reading p_H meter is described. The circuit is self-calibrating, and can be used with glass, H_2, quinhydrone, or other electrode systems, and a suitable electrometer. A simplified vac.-tube electrometer is described, and typical results with various electrodes are recorded. L. S. T.

Measurement of high insulation resistance with valve electrometer. T. AKAHIRA and M. KAMAZAWA (Bull. Inst. Phys. Chem. Res. Japan, 1940, **19**, 537—547).—Apparatus is described in which a valve electrometer is used to measure the rate of charging of a condenser supplied with a small continuous current, and by means of which currents from 10^{-7} to 10^{-14} amp. can be measured. Resistances of Japanese amber, quartz, and ebonite have been measured. O. D. S.

Temperature-independent electrical resistances. F. HILDEBRANDT (Z. tech. Physik, 1940, **21**, 64).—The compensation of the temp. variation of electrical resistances, and the production of resistances with any desired temp. coeff., by combination with a second resistance of different temp. coeff. with or without a subsidiary current is described. O. D. S.

Application of electrometric methods in microchemistry. U. EHRHARDT (Angew. Chem., 1940, **53**, 125—128).—Apparatus and circuits adapted to working on a micro-scale are described. F. J. G.

Energy variations in a cyclotron ion beam. G. K. GREEN and P. G. KRUGER (Physical Rev., 1938, [ii], **53**, 927—928).—Energy variations in the 1-Me.v. deuteron beam from a small cyclotron are described and discussed. L. S. T.

Cyclotron magnet-current stabiliser. T. PERRY (Physical Rev., 1938, [ii], **53**, 943).—The device described maintains the cyclotron magnet current const. to ±0·02%. L. S. T.

Automatic pipette. G. MIDDLETON (Chem. and Ind., 1940, 607—608).—The pipette described contains no ground joints and gives an accuracy ~5% in a 1- or 2-mil size and ~2½% in 5- and 10-mil sizes. L. J. J.

Automatic multiple burette. J. S. TAPP (Canad. J. Res., 1940, **18**, B, 217—222).—An automatic

apparatus for delivering small measured quantities at regular time intervals is described. The valves comprise short pieces of rubber tubing, pinched against a wooden block by rocker arms, which are released at suitable time intervals by small cams comprising discs carrying a small machine screw. The apparatus can be used for discharging the same or different liquids from the different jets, whilst the liquid is not subject to evaporation or contamination. J. W. S.

Accurate timing equipment for viscosity determinations. E. M. FRY, jun., and E. L. BALDESCHWIELER (Ind. Eng. Chem. [Anal.], 1940, **12**, 472—473).—Method and apparatus for timing with an accuracy of < ±0·1% on intervals of <100 sec. are described. L. S. T.

Combustion boat tongs. H. F. PRIEST (Ind. Eng. Chem. [Anal.], 1940, **12**, 473).—The new design of tongs described holds the boat firmly and rigidly while being moved in the combustion tube, enables the position of the boat to be reproduced exactly, and expedites combustion analyses. L. S. T.

Apparatus for maintaining constant levels in a water-bath and a distilling flask. F. E. HOLMES (Ind. Eng. Chem. [Anal.], 1940, **12**, 483—485).—One of the pieces of apparatus described maintains the level of H_2O in a large bath (50 × 50 cm.) within <1 mm., and the other enables a small distilling flask to be used in the continuous distillation of a large vol. of liquid from a reservoir. L. S. T.

Distillation apparatus with plane ground joints, without bungs. C. L. PALFRAY (Document. sci., 1937, **6**, 81—82; Chem. Zentr., 1937, i, 4830). A. J. E. W.

Apparatus for Gutzeit test for arsenic.—See A., 1940, III, 778.

Spinning-band fractionating column for use with small quantities of liquids. R. H. BAKER, C. BARKENBUS, and C. A. ROSWELL (Ind. Eng. Chem. [Anal.], 1940, **12**, 468—470).—Details of construction of a 70-plate spinning-band column, which has a hold-up of 0·1 c.c. per plate, are given. L. S. T.

Suction filtration apparatus for sampling filtrates under constant pressure. E. T. FUKUNAGA and L. A. DEAN (Ind. Eng. Chem. [Anal.], 1940, **12**, 471).—The apparatus described and illustrated permits rapid removal of aliquot portions of filtrate without disconnexions or changes in pressure. L. S. T.

Concentration of isotopes by thermal diffusion: rate of approach to equilibrium. J. BARDEEN (Physical Rev., 1940, [ii], **58**, 94—95; cf. A., 1940, I, 176).—Mathematical. Additions and corrections. N. M. B.

Methods of producing gas-free surfaces. H. E. FARNSWORTH and R. P. WINCH (Physical Rev., 1938, [ii], **53**, 935).—Ag surfaces obtained by deposition in a vac. of a thin film evaporated from outgassed Ag crystals are less free from gas than those obtained directly by prolonged electron bombardment. L. S. T.

Condensation hygrometer. T. OKADA and M. TAMURA (Proc. Imp. Acad. Tokyo, 1940, **16**, 208—213; cf. A., 1940, I, 377).—Calculation of the

humidity in the new condensation hygrometer is modified by the inclusion of several small correction terms. Comparison with an Assman aspiration psycrometer shows that the instrument would be sufficiently accurate for routine meteorological observations.　　　D. F. R.

Stopcock lubricant for use with [organic] solvents, acids, or alkalis. P. W. ROHRBAUGH (Science, 1940, 92, 114).—Graphite forms a suitable lubricant for glass taps etc. Only a very small amount should be used.　　　L. S. T.

Vacuum stirrer for the laboratory. J. H. READ (J.S.C.I., 1940, 59, 218).—The apparatus has been used for the vigorous agitation of oils under high vac. at temp. up to 300°; it is vac.-tight at the pressures obtainable with a Hyvac pump, and can be run at 700 r.p.m. or more. Provision is made against loss of material by frothing. The stirrer can be used under conditions which lead to the softening and decomp. of rubber stoppers.

Preparation of Cellophane membranes of graded permeability.—See A., 1940, III, 778.

Geochemistry.

Occurrence of gallium in hot springs of Japan. K. KURODA (Bull. Chem. Soc. Japan, 1940, 15, 234—236).—The approx. Ga content, estimated spectrographically, is recorded for 11 springs. The highest observed is $1—5 \times 10^{-5}$ g. per l.　　　F. L. U.

Occurrence of beryllium in hot springs of Japan. K. KURODA (Bull. Chem. Soc. Japan, 1940, 15, 237—238; cf. A., 1939, I, 541).—Up to $5—10 \times 10^{-5}$ g. per l. of Be has been found spectrographically in 11 springs.　　　F. L. U.

Ground water in the Oklahoma Panhandle. S. L. SCHOFF (Econ. Geol., 1940, 35, 534—545).—The H_2O table and the chief sources of ground H_2O are described.　　　L. S. T.

Chemistry and hydrography of lakes Tanganyika and Nyasa. R. S. A. BEAUCHAMP (Nature, 1940, 146, 253—256).　　　L. S. T.

Geology and artesian water resources of a portion of the Virginia coastal plain. D. J. CEDERSTROM (Bull. Geol. Soc. Amer., 1938, 49, 1947).—H_2O at Franklin, Courtland, Smithfield, and other points contains 2—6 p.p.m. of F' from an unknown source.　　　L. S. T.

Deposition of calcium sulphate from seawater. E. POSNJAK (Amer. J. Sci., 1940, 238, 559—568; cf. A., 1939, I, 200).—Determinations of the solubilities of gypsum (I) and anhydrite (II) at 30° in solutions containing NaCl 2·72, $MgCl_2$ 0·38, $MgSO_4$ 0·17, and K_2SO_4 0·09% are recorded. The solubilities increase rapidly in presence of increasing concns. of the sea salts, reach a max. at ~ twice the usual salinity of sea-H_2O, and then gradually decrease. The decrease for (II) is the more rapid, and the curves for (I) and (II) intersect at ~4·8 times the usual salinity of sea-water, the point at which (II) becomes the stable phase. Sea-H_2O is unsaturated with respect to $CaSO_4$, and only after its salt content has increased by evaporation to 3·35 times the usual salinity can deposition take place. Between this concn. and that required for stable deposition of (II) nearly half of the total amount of $CaSO_4$ present in sea-H_2O will be deposited at 30° as (I). In a marine basin much of the $CaSO_4$ will be deposited as (I), and sedimentary marine deposits of pure (II) must either be derived, at least in part, from (I), or have been formed close to or above 42°, the transition point of the two minerals.　　　L. S. T.

Constitution of the solfataric gases at Kilauea volcano, Hawaii. S. S. BALLARD (Physical Rev., 1938, [ii], 54, 236).—The chief constituent, other than steam, is SO_2 (90% of some samples). CO_2 is present in amounts $\sim\frac{1}{12}$ of the SO_2. O_2 and N_2 are present in widely-varying amounts, but always in approx. the atm. ratio. A, but no other rare gas, is present in the N_2 residue. No significant trace of the combustible gases ordinarily associated with volcanism was detected in any sample.　　　L. S. T.

Two new constituents of meteoritic gases. J. D. BUDDHUE (Amer. J. Sci., 1940, 238, 569—572).—Spectrographic examination of the gases evolved by heating the stony meteorites from Holbrook, Arizona, and Washougal, Washington, show, in addition to N_2, H_2, oxides of C, and possibly the C_2 mol., the presence of $(CN)_2$ and Ne. He also occurred in the gases from the Holbrook meteorite. A was absent. The presence of $(CN)_2$ strengthens the supposed connexion between meteorites and comets. Both meteorites showed luminescence.　　　L. S. T.

Cherts in the Karroo system. E. D. MOUNTAIN and J. J. FRANKEL (S. African J. Sci., 1939, 36, 183—187).—Cherts from the Upper Dwyka beds, near Grahamstown, and from the Molteno beds between Jamestown and Aliwal North are described. Chemical analyses are recorded. Differences between the two cherts are ascribed to slightly different modes of origin, both being due to metasomatic alteration of shale.　　　L. S. T.

Origin of the calcareous deposits of the Rietspruit Valley, Orange Free State. J. DE VILLIERS (S. African J. Sci., 1939, 36, 170—175).—The Portland nodular limestone is of secondary origin, and its formation from dolerite rock is described. The Helpmekaar friable limestone resulted from the decomp. *in situ* of a thick travertine bed due to leaching, and the Rietgat pulverulent limestone from the decomp. *in situ* of a bed of nodular limestone.　　　L. S. T.

Volcanic ash as a source of silica for the silicification of wood. K. J. MURATA (Amer. J. Sci., 1940, 238, 586—596).—Volcanic ash is a rich source of readily-available SiO_2 for geochemical processes, and the common association of silicified wood with volcanic ash is regarded as the result of a genetic relationship arising from the alterability of the ash. Silicified wood may serve as an indicator for volcanic material in sedimentary deposits. Occurrences of

silicified wood in the United States are listed and classified.   L. S. T.

Geology of the oil-field belt of S.W. Iran and Iraq. G. M. LEES and F. D. S. RICHARDSON (Geol. Mag., 1940, **77**, 227—252).—The main geological features of this belt, the mode of occurrence of the oil, and the distribution of the oil-fields are described.   L. S. T.

Leucite-bearing rocks of the West Kimberley area, Western Australia. A. WADE and R. T. PRIDER (Quart. J. Geol. Soc., 1940, **96**, 39—98).— A no. of occurrences of post-Permian volcanic rocks in this district are described. They are among the richest leucite-bearing rocks yet described. Four new rock-types, fitzroyite, cedricite, mamilite, and wolgidite, are described, and their chemical analyses discussed and compared with those of similar, known types. Petrogenesis is discussed. Chemical analyses of *magnophorite*, a katophoritic amphibole, and *wadeite*, essentially a K Zr silicate, both from wolgidite, and a titaniferous phlogopite from fitzroyite, are also recorded.   L. S. T.

Optical properties of fluorite in the 6 μ region. D. WILLIAMS (Physical Rev., 1938, [ii], **53**, 930).— Coloured varieties of fluorite (I) show intense bands in this region, and even colourless varieties show weak bands. Anomalous dispersion occurs when coloured (I) is used as prism material.   L. S. T.

Granites of the Front Range, Colorado : the Indian Creek plutons. M. F. BOOS and E. ABERDEEN (Bull. Geol. Soc. Amer., 1940, **51**, 697—730).— Three chemical analyses are included.   L. S. T.

Association of magnesia with silica in a pure magnesium clay. P. G. NUTTING (J. Washington Acad. Sci., 1940, **30**, 233—237).—A white clay occurring near Hector, California, is a nearly pure Mg silicate of the montmorillonite type ; it swells largely and disperses readily in H_2O like the familiar Wyoming bentonites. In spite of cryst. nature of the mineral, the Mg is removed completely by electro-dialysis, leaving pure SiO_2. In hot acid solutions, this clay breaks down like the Wyoming bentonite, but at much lower acid concns. Solubility data in dil. HCl are tabulated. A p_H study of the clay–acid equilibrium filtrates indicates that H˙ are inactivated either by physical adsorption or chemical reaction, or that OH′ are released over a certain range.   L. S. T.

Movement of potassium in irrigated and fertilised red sandy clay. D. LACHOWER (J. Agric. Sci., 1940, **30**, 498—502).—Addition of K_2SO_4 increases sol., exchangeable and non-exchangeable K. Increased irrigation carries K into lower soil layers and increases loss by leaching. In the absence of irrigation K ascends in soil in summer and sinks in winter.   R. L. E.

Hydration mechanism of the clay mineral montmorillonite saturated with various cations. S. B. HENDRICKS, R. A. NELSON, and L. T. ALEXANDER (J. Amer. Chem. Soc., 1940, **62**, 1457—1464).— The absorption of H_2O by the Li, Na, K, Cs, Mg, Ca, Sr, and Ba derivatives of montmorillonite and of the free acid has been measured in air of R.H. 5—90%, and is discussed in relation to the changes in the X-ray

spectra. The exchangeable cations are located between the silicate layers of the mineral. In the Mg, Ca, Sr, and Ba derivatives the initial stage of H_2O absorption involves hydration of the cation with 6 mols. of H_2O. This is followed by completion of a H_2O layer of hexagonal type structure, whilst a second layer, of similar structure, is taken up at high R.H. Only 3 H_2O mols. are required for hydration of the Li ion, whilst the Na, K, Cs, and H ions are not hydrated.   J. W. S.

Colour reactions between clays and amines. E. A. HAUSER and M. B. LEGGETT (J. Amer. Chem. Soc., 1940, **62**, 1811—1814).—Aromatic amines give colour reactions with clays. The colours result on grinding the dry solids, or directly on contact between clay and liquid or dissolved amine. Aliphatic and saturated cyclic amines give no reaction. Substituents alter the colour, and this is discussed in detail, as also are the effects of oxidising and reducing agents. It is suggested that the cause of the phenomenon is co-ordination between the N of the amine and an unsaturated metallic atom of the clay, resulting in resonance in the aromatic nucleus.   F. J. G.

Specific gravities of clays. V. L. BOSAZZA (S. African J. Sci., 1939, **36**, 155—157).—The sp. gr. of refractory and other clays of the Witwatersrand area and of clays from the Eastern Province are tabulated and discussed. In certain cases, the vals. differ with the liquid used, viz., CCl_4, EtOH, or H_2O.   L. S. T.

Constitution and classification of the clay minerals. J. S. HOSKING (J. Proc. Austral. Chem. Inst., 1940, **7**, 234—250).—A review.

Effect of heat on the clay minerals illite and montmorillonite. R. E. GRIM and W. F. BRADLEY (J. Amer. Ceram. Soc., 1940, **23**, 242—248).—X-Ray and optical examinations were made on three purified illites, a purified montmorillonite (I), and a natural clay [containing (I), quartz, and limonite] after heating at successive temp. up to 1400°. Illite loses H_2O from its lattice at 350—600° and its characteristic lattice is destroyed at 800—850°. At 850° a spinel phase appears and increases in quantity up to 1100—1200°. The spinel appears to form from the middle lattice plane (containing Al_2O_3, MgO, and Fe_2O_3), whilst the outer planes form an amorphous glass (950°). Mullite (II) appears at 1100° and persists to 1400°, whilst at 1300° the spinel dissolves in the glass. The quartz dissolves in the glass at 1050°. (I) loses H_2O at 500—600° and the destruction of the characteristic lattice is complete at 800—850°. A new spinel phase develops at 850° and increases in quantity up to 1100°. (II) forms in increasing quantity at >850° and at 1300° all the spinel dissolves in the glass. Whilst the lattice planes are destroyed in the same way as those of illite, the outer planes of the former provide some SiO_2 which inverts to cristobalite before dissolving in the glass at 1300°.   J. A. S.

Elkonite, a colloidal clay. M. L. TAINTER, G. KULCHAR, and A. B. STOCKTON (J. Amer. Pharm. Assoc., 1940, **29**, 306—310).—Elkonite, a naturally occurring clay (H_2O 12·83, SiO_2 52·7, Fe_2O_3 1·96, Al_2O_3 17·44, CaO 0·91, MgO 3·63%), is hydrophilic

and forms a gel at concn. of 15% in H_2O. The absorptive power and other physico-chemical characteristics indicate its possible use in gastro-intestinal disorders and as an ointment base.

F. O. H.

Minor elements in sphalerite. R. E. STOIBER (Econ. Geol., 1940, **35**, 501—519).—The spectrographic analyses recorded for sphalerite (I) from numerous, diverse localities show that the variations in minor element content can be correlated with two geological factors, viz., the temp. type of the (I) deposit, and the metallogenetic province represented. Sb, Hg, Tl, and As are restricted largely to (I) from low-temp. mineral deposits, and Mo to (I) from mesothermal deposits. [Mn] is greatest in (I) from high-temp. occurrences, In in that from mesothermal deposits, and Ga and Ge increase with decreasing temp. of deposition. The largest concns. of Sn and Cd appear to be most common in (I) from deposits of other than low-temp. type. Mississippi Valley deposits, European Zn ores of Mississippi Valley type, and barite deposits of Central Kentucky are all of low-temp. origin, and (I) from each of these metallogenetic regions contains minor elements of distinctive kind and amount.   L. S. T.

High - temperature, intermediate - pressure molybdenite deposit at Rencontre East, Newfoundland. D. E. WHITE and E. SAMPSON (Econ. Geol., 1939, **34**, 133).—Molybdenite (I) ore occurs in the aplite along part of the margin of a large granite batholith. In the ore zone quartz (II), muscovite (III), (I), fluorite, and minor chlorite with magnetite have replaced aplite. (II)- and (III)-rich rocks are distinctive. (I) generally favours muscovitised rock. Mineralising solutions appear to have penetrated the aplite intimately without marked structural control.

L. S. T.

Vein solutions and rock alteration in the Boulder Co. tungsten district of Colorado. T. S. LOVERING (Econ. Geol., 1939, **34**, 132—133).— Zones of minerals apparent in the alteration of oligoclase granite as a ferberite (I) vein is approached are described. The vein filling consists of (I) and many generations of fine-grained quartz carrying minor amounts of ankerite, alunite, clay minerals, etc. The succession of minerals and their character indicate acid sulphate solutions passing through the vein fissures for a long period, and a shift toward alkaline solutions when the (I) was deposited.   L. S. T.

Aikinite and silver enrichment at the St. Louis mine, Butte Co., Idaho. A. L. ANDERSON (Econ. Geol., 1940, **35**, 520—533).—The occurrence of abundant amounts of the rare mineral aikinite (I) ($Cu_2S,2PbS,Bi_2S_3$) with a high Ag content is described. The Ag content resulted from selective replacement of the (I) by supergene argentite and native Ag.

L. S. T.

Ore deposits at Camp Albion, Boulder Co., Colorado. E. E. WAHLSTROM (Econ. Geol., 1940, **35**, 477—500).—The ores consist of argentiferous galena, tetradymite, pyrite, chalcopyrite, sphalerite, magnetite, and molybdenite in a gangue of soda pyroxene, soda asbestos, coarsely cryst. quartz,

calcite, felspar, and fluorite. The minerals are described, and three chemical analyses recorded. Paragenesis is discussed.   L. S. T.

Thermal conductivity of rocks and its dependence on temperature and composition. I, II. F. BIRCH and H. CLARK (Amer. J. Sci., 1940, **238**, 529—558, 613—635).—Apparatus for measuring abs. thermal conductivity between 0° and 500° is described. Results for 18 igneous and 7 sedimentary and metamorphic rocks, single crystals of quartz, calcite, and halite, and four glasses are recorded, and discussed in the light of theories of heat conduction in crystals. At 0°, the conductivities of all the rocks lie between 0·014 and 0·004 g.-cal. per cm. per sec. per degree, and at 200°, between 0·009 and 0·004. The conductivities of the poorest conductors, the glasses and the felspar aggregates, increase with a rise in temp., but those of the other cryst. materials decrease. The ultrabasic rocks are the aggregates with the highest conductivities. A method of accounting for the conductivities of fresh igneous rocks in terms of their mineral compositions and the measured conductivities of approx. monomineral aggregates is given.   L. S. T.

Thermal conductivity of some sedimentary rocks. C. D. NIVEN (Canad. J. Res., 1940, **18, A**, 132—137).—The thermal conductivities of Canadian marbles, limestones, and slate have been determined at 240—700° F., the results being of the same order as found by other investigators. Since in each case the conductivity is lower after heating, it is inferred that the measurements cannot be applied to the conductivity of sedimentary rocks in the earth.   J. W. S.

Spontaneous rock expansion. G. W. BAIN (Bull. Geol. Soc. Amer., 1938, **49**, 1864).—Highly-folded rock in quarries, mines, and foundation excavations expands spontaneously when free space is provided. Rock pressures up to 1500 kg. per sq. cm. at <50 ft. depth are exerted. Expansion is due to compression when the rock was folded.   L. S. T.

Origin of talc and soapstone deposits of Virginia. J. D. BURFOOT, jun. (Bull. Geol. Soc. Amer., 1938, **49**, 1946).—A discussion.   L. S. T.

Nickel deposit near Gold Hill, Colorado. E. N. GODDARD and T. S. LOVERING (Econ. Geol., 1939, **34**, 131).—The deposit occurs in highly metamorphosed sediments of the Idaho Springs formation. Disseminated intergrowths of pyrite, pyrrhotite, chalcopyrite, pentlandite, and niccolite have replaced amphibole in the more calcic beds of a CaO–silicate layer in this formation. The primary ore yields Ni 0·41—6, Co 0—0·60%, and small amounts of Cu. Supergene ore contains Ni 1·32—13·02, Co 0·22—6·22, and Cu 0·05—31·60%.   L. S. T.

Rock alteration in the Uchi gold area, Ontario. J. D. BATEMAN (Econ. Geol., 1940, **35**, 382—404).— A genetic relationship between granitic intrusion and Au deposition is proposed for this area. Intrusion of the younger granite, introduction of dyke rocks, mineralisation, and wall rock alteration are all related parts of a sequence of events connected with a single period of magmatic activity. Chemical analyses [W. F. GREEN] are recorded.   L. S. T.