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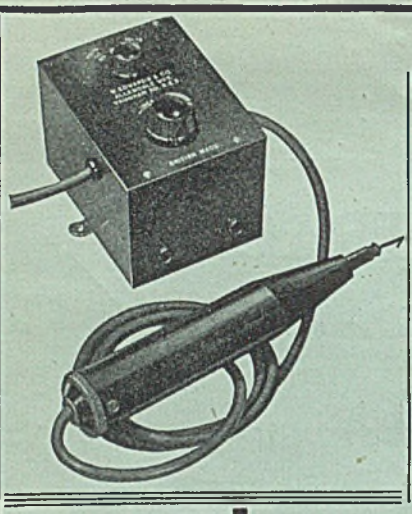

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NOTE ON THE ARRANGEMENT OF ABSTRACTS

The Abstracts are classified by subject according to the Universal Decimal Classification, and arranged in order of their U.D.C. numbers. (An abridged version of the U.D.C. accompanies the Annual Index.) An Abstract of interest under more than one head has additional U.D.C. numbers, linked by the colon sign, " : " e.g. "536.21 : 548.0 Conduction of heat in crystals." The Abstract is printed once only, under the main number, e.g. in the section "HEAT 536," but Cross-references are inserted under the other numbers, e.g. "548.0 : 536.21 *see Abstr.* 1234" in the section "CRYSTALLOGRAPHY 548." These Cross-references should be investigated, therefore, when a particular section is being searched, as they contain additional matter relevant to that section. A Cross-reference does *not* refer to the Abstract which appears immediately above it.

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389.64 : 534.773.2 *see Abstr.* 424

MATHEMATICS 51

512.31 : 621.318.7 = 4 360

On a type of polynomial occurring in a study of electric filters. PARODI, M. *Rev. Gén. Élect.*, **51**, 142–4 (*Feb.*, 1942).—Three determinantal polynomials, $D_n(x)$, $\delta_n(x)$ and $d_n(x)$, are considered. In each, the diagonals immediately above and below the principal diagonal consist of a set of units, while the principal diagonals are $(x, x, \ldots, x)$, $(x+1, x, \ldots, x, x+1)$ and $(\frac{1}{2}x, x, \ldots, x, \frac{1}{2}x)$ respectively. Thus

$$D_n(x) = \begin{vmatrix} x & 1 & 0 & \cdots & 0 \\ 1 & x & 1 & & \vdots \\ 0 & 1 & x & \ddots & \\ \vdots & & & x & 1 \\ 0 & \cdots & & 1 & x \end{vmatrix}$$

It is shown that $D_n - xD_{n-1} + D_{n-2} = 0$ and that $\delta_n(x) = (x+2)D_{n-1}(x)$ and $d_n(x) = (\frac{1}{4}x^2-1)D_{n-2}(x)$, so a study of $D_n(x)$ alone is necessary. If $D_0(x) = 1$, $D_1(x) = x$ it is shown that $(1 - xz + z^2)^{-1} = \sum D_n(x)z^n$ and that, if $x = 2\cos\theta$, then $D_n = \{\sin(n+1)\theta\}/\sin\theta$. Various relations satisfied by D_n are found and the polynomial is related to a certain continued fraction and to the hypergeometric function. The polynomials occur in a calculation of the frequencies of oscillation of a set of coupled circuits [Abstr. 1503 B (1940)]. L. S. G.

512.83 : 519.443 = 4 361

A property of determinants and its application to the calculation of the characters of the symmetric group. COMÉT, S. *K. Fysiogr. Sällsk. Lund Förh.*, **14** (*No.* 7) 84–94 (1944).—Let (a_{jk}) $(j, k = 1, \ldots, m)$ be a given matrix and c_n the nth elementary symmetric function of m indeterminates, $x_1, \ldots, x_m$ $(0 \leqslant n \leqslant m)$. Denote by (ρ) the combination $(r_1, \ldots, r_n)$ of n different numbers chosen from the set $1, \ldots, m$. For all k write

$$a_{jk}^{(\rho)} = x_k a_{jk} \quad \text{for } j = r_1, r_2, \ldots, r_n,$$
$$= a_{jk} \quad \text{for all other } j.$$

The theorem proved is that

$$C_n|a_{jk}| = \sum_{(\rho)} |a_{jk}^{(\rho)}|$$

where (ρ) extends over all $\binom{m}{n}$ possible values. Formulae due to Weyl and to Murnaghan are deduced and general expressions for the characters are given. Some particular cases are noted. L. S. G.

512.831 : 519.281.2 *see Abstr.* 371

513.182 = 4 362

A quadrilateral bordered by similar isosceles triangles. THÉBAULT, M. V. *Ann. Soc. Sci. Brux.*, **60**, 64–70 (*May* 15, 1940).—The triangles are drawn on the exterior of the quadrilateral, which is convex. Various metrical theorems relating to the configuration are proved by elementary trigonometric methods. L. S. G.

513.71 : 513.813 363

The Riemann tensor in a completely harmonic V_4. RUSE, H. S. *Proc. Roy. Soc. Edinb. A*, **62**, *Pt II* (*No.* 18) 156–63 (1945).—A completely harmonic V_n is defined, and the conditions that V_n should be such are, amongst others, that $R_{ij} = kg_{ij}$ $(k = \text{const.})$, and that $\sum' g^{pr}g^{qs}R_{pijq}R_{rkls} = \theta\sum' g_{ij}g_{kl}$, where R_{ijkl} is the Riemann tensor, g_{ij} is the fundamental tensor of V_n, and θ is a scalar. The central problem is whether a completely harmonic V_n is of constant curvature. A definite answer is not available, but some progress is made in the determination of the nature of completely harmonic V_n's. All types of V_4 which are algebraically possible when the Riemann tensor satisfies the above conditions are obtained. If V_4 is of signature ± 2, then V_4 is of constant curvature. But when the signature is not ± 2 there is no algebraic necessity for the curvature to be constant. The results of the present paper provide an interesting illustration of the methods of a previous paper [Abstr. 34 (1945)]. L. S. G.

513.813 : 513.71 *see Abstr.* 363

517.27 364

The method of steepest descent for non-linear minimization problems. CURRY, H. B. *Quart. Appl. Math.*, **2**, 258–61 (*Oct.*, 1944).—The problem is that of minimizing a function $G(x_1, \ldots, x_n)$ of n real variables and includes, as a special case, that of solving a set of simultaneous equations,

$$f_i(x_1, \ldots, x_n) = 0 \qquad (i = 1, 2, \ldots, m), \qquad (1)$$

since the function $G(x_1, \ldots, x_n) = \sum_{i=1}^{m} f_i^2$ has a minimum at a solution of (1). The method, which is not new [Abstr. 1647 (1945)], leads to a practical process for the approximate evaluation of a stationary point of G. An outline of a proof of convergence is given. This is elementary and gives a weak result. Previously a proof had been given, in the linear case only, by Temple [Abstr. 1498 (1939)]. L. S. G.

517.512.2 : 548.73 : 621.317.757 365

A photo-electric Fourier transformer. BORN, M., FÜRTH, R., AND PRINGLE, R. W. *Nature, Lond.*, **156**, 756–7 (*Dec.* 22, 1945).—The instrument traces the graph of the function

$$g'(y) = \int_a^b f(x)\cos(yx + \delta)dx$$

on a c.r.t. screen, for any value of δ. The complex "Fourier transform" of $f(x)$ can be got by inserting 2 values of δ differing by $\pi/2$. A pattern of parallel optical fringes is projected on to an opaque mask having the contour of $f(x)$ and the transmitted light concentrated on to a photo-cell. The fringe system is made to expand and shrink periodically in synchronism with the c.r.o. sweep by rotating a glass

disc carrying the photographically produced fringes. A full description is to be published later.

517.63 : 517.947.44 : 621.396.616 366

Three-dimensional Fourier transforms and their application to Maxwell's equations. ADLER, F. T. *J. Appl. Phys.*, **16**, 545–50 (*Sept.*, 1945).—The theory of finite Fourier transforms in three dimensions is discussed and used, in steady-state problems, to transfer Maxwell's equations between the field quantities into algebraic equations between the vectors. As an example a rectangular cavity resonator is discussed. The resonant frequencies and the functional form of the field are derived. L. S. G.

517.65 = 4 367

On a formula of Nielsen. HUMBERT, P. *Ann. Soc. Sci. Brux.*, **60**, 61–3 (*May* 15, 1940).—Nielsen's integral formula for the sum, $C^2(x) + S^2(x)$, where $C(x) = \int_x^\infty \cos x^2 dx$, $S(x) = \int_x^\infty \sin x^2 dx$, implies that this sum is a function of x^2. This is not correct, and, by means of the operational calculus, the correct formula is obtained. This is

$$C^2(x) + S^2(x) = \int_0^\infty e^{-2xu} \frac{\sin u^2}{u} du$$ L. S. G.

517.947.44 : 621.396.616 : 517.63 *see Abstr.* 366

517.948.32 368

Two integral equations. BATEMAN, H. *Proc. Nat. Acad. Sci., Wash.*, **31**, 196–200 (*July*, 1945).—Let $k(s, t) = g(s, t) - cg(s, a - t)$ where $g(s, t)$ is a real continuous kernel for $0 \leqslant s, t \leqslant a$ and c is a constant. The equations solved are

$$f(s) = \int_0^a k(s, t)F(t)dt$$

and $$f(s) = F(s) - x\int_0^a k(s, t)F(t)dt$$ L. S. G.

517.948.35 369

On a class of hermitian transformations containing self-adjoint differential operators. HAMBURGER, H. L. *Proc. Nat. Acad. Sci., Wash.*, **31**, 185–9 (*July*, 1945.)—A main theorem concerning the class of transformations considered is stated and various results are deduced from it. The note is introductory and a more detailed paper is promised. L. S. G.

519.271 : 53.088 370

Accuracy of constants in exponential decay as obtained from finite samples—a review. COPELAND, P. L. *Amer. J. Phys.*, **13**, 215–22 (*Aug.*, 1945).—In an exponential decay, if q_0 is the initial amount of material and q the amount surviving after a time t the decay constant, k, is given by $k = t^{-1} \log (q_0/q)$. The error in k due to uncertainties in both q_0 and q is discussed. It is not always possible to make such a large number of observations that statistical fluctuations are negligible in the determination of k. Such fluctuations in small samples are considered and the distribution of errors in the average life of finite samples is calculated. Some examples of phenomena where statistical considerations are important are discussed. L. S. G.

519.281.2 : 512.831 371

Studies in practical mathematics. IV. On linear approximation by least squares. AITKEN, A. C. *Proc. Roy. Soc. Edinb. A*, **62**, *Pt II* (*No.* 16) 138–46 (1945).—Matrix methods are used to develop the familiar theory of linear approximation by least squares, full use being made of the properties of the variance matrix. The variance matrix, V, of a column vector, X, is the mean value of the symmetric matrix XX^* (the star (*) denoting the transpose), namely $V = [\rho_{ij}\sigma_i\sigma_j]$ where ρ_{ij} is the correlation coefficient of x_i and x_j. The problems considered are (1) that of obtaining by least squares the best solution of a set of inconsistent linear equations $AX = U$ where the elements of U are subject to error and A is a given $m \times n$ matrix with $m > n$, (2) that of representing a set of data $u(x_i)$ by least squares in the form $PB = U$ where P is a matrix $[p_j(x_i)]$, the $p_1(x), \ldots, p_k(x)$ being given functions, $k \leqslant n - 1$, and B is a column vector of constants to be determined. In (1) the the normal equations are obtained in the form $A^*V^{-1}AX = A^*V^{-1}U$ and the variance matrices of the solutions and of the residuals are given. The problem (1) where the elements of X are subject to a number of linear restrictions is solved by two methods which are shown to be equivalent. Examples are given. L. S. G.

519.283 : 620.113 372

Statistical methods in quality control. V. Variations to be expected in sampling. VI. Charts for go-and-no-go inspection. *Elect. Engng, N.Y.*, **64**, 363–4 (*Oct.*); 401–2 (*Nov.*, 1945).

519.443 : 512.83 = 4 *see Abstr.* 361

519.46 373

On algebraic Lie algebras. CHEVALLEY, C., AND TUAN, H. F. *Proc. Nat. Acad. Sci., Wash.*, **31**, 195–6 (*July*, 1945).—A subgroup A of the full linear group $GL(n, C)$ in n variables (C being the field of complex numbers) is said to be algebraic if the condition for a matrix M of $GL(n, C)$ to belong to A can be expressed by a system of algebraic equations in the coefficients of M. A is then a complex Lie group. A study is made of the Lie algebras which can be considered as Lie algebras of algebraic Lie groups. It is shown that any algebraic Lie algebra, over C, is the Lie algebra of an algebraic group of matrices. L. S. G.

ASTRONOMY . GEODESY 52

523.112 : 531.51 374

Influence of the expansion of space on the gravitation fields surrounding the individual stars. EINSTEIN, A., AND STRAUS, E. G. *Rev. Mod. Phys.*, **17**, 120–4 (*April-July*, 1945).—It is shown that the static Schwarzschild solution of Einstein's gravitational equations can be used to describe the field surrounding a mass-particle embedded in an expanding space-time. The Schwarzschild solution is valid within a region G surrounding the particle whilst outside G, the field

is that of the expanding space-time. The two fields are shown to be continuous at the boundary of G. The internal solution is not therefore dependent on the time: the boundary of G, however, is so dependent. [See also Abstr. 2819 (1933), 4136 (1932)]. G. C. McV.

525.36 375

The Foucault pendulum star path and the n-leaved rose. KIMBALL, W. S. *Amer. J. Phys.*, **13**, 271–7 (*Oct.*, 1945).—The equations of motion of the pendulum bob are set up and solved to give the path. The cusps and constant change of direction of the latter are studied. The star path in polar co-ordinates is obtained and this leads to the n-leaved rose. The time rate of change of the direction of the radius vector in this rose is constant and equal to the magnitude of the earth's rotation component at the latitude in question. The star path is constructed in two cases. L. S. G.

525.75 : 535.247.4 = 4 *see Abstr.* 435

527 : 538.74 : 531.383 *see Abstr.* 382

529.7 376

The measurement of time. SPENCER JONES, H. *Endeavour*, **4**, 123–30 (*Oct.*, 1945).—Recent improvements in methods of observation are described which enable astronomical time to be determined from star transits to an accuracy of 2–3 msecs. The best pendulum clocks have erratic variations of up to 10 × this amount which make them inadequate. The article describes new electronic clocks controlled by quartz resonators which keep constant time to better than 1 msec per day and whose rate relative to each other can be measured to 0·01 msec per day.

PHYSICS 53

53.081 : 533.22 = 3 377

Secondary concepts and the gas law. POHL, R. W. *Z. Phys.*, **121** (*Nos.* 9–10) 543–5 (1943).—Secondary concepts (concepts indefinable apart from special units) should be avoided. The gas law should be expressed as $pV = MRT_{abs}$ or $pV = nkT_{abs}$ (M = total mass, n = no. of molecules in vol. V) with the experimentally determined constants $R = 8{\cdot}31$ joules/gm.mol.degree and $k = 1{\cdot}38 \times 10^{-23}$ joules/degree. H. G. S.

53.088 : 519.271 *see Abstr.* 370

FUNDAMENTALS 530.1

530.12 378

The regraduation of clocks in spherically symmetric space-times of general relativity. MCVITTIE, G. C. *Proc. Roy. Soc. Edinb.A*, **62**, *Pt II* (*No.* 17) 147–55 (1945).—[See Abstr. 349 (1943), 969 (1941)]. The changes in his description of events brought about by an arbitrary regraduation of an observer's clock are examined, taking the axioms of general relativity as fundamental. It is shown that regraduation does not imply a change from one Riemannian space-time to another but merely a co-ordinate transformation within space-time. A generalization of the "dynamical time" of kinematical relativity is a by-product of the investigation.

530.12 379

Relativistic invariance. THOMAS, L. H. *Rev. Mod. Phys.*, **17**, 182–6 (*April–July*, 1945).—A new mathematical formalism is set up by which classical and quantum dynamics are expressed in a form in which time and space variables are treated in the same way. The analysis uses a ten-parameter family of observers which are "equivalent" in the sense of general relativity. It is also proved that the latter theory is not the most general one possible as it implies that the ten-parameter family falls into a four-parameter set of six-parameter sub-families. G. C. McV.

530.145 : 539.153.4 = 3 380

Extension of the statistical theory of the atom. GOMBÁS, P. *Z. Phys.*, **121** (*Nos.* 9–10) 523–42 (1943). —The extension is derived from the consideration of the correlation of the electrons with anti-parallel spin. The extended model, in analogy with the Jensen modification of the Fermi–Dirac model, is modified by replacing the sum of the exchange and polarization correction terms by the Fermi–Arnold correction in the extended equation at the atomic boundary while retaining the new value of the boundary density. Owing to the polarization in the interaction of atoms and ions there is an additional attraction. H. G. S.

MECHANICS OF SOLIDS 531

531.314.2 381

A "power function" for the determination of Lagrangian generalized forces. WELLS, D. A. *J. Appl. Phys.*, **16**, 535–8 (*Sept.*, 1945).—The power function, P, which is such that $F(q_r) = \partial P/\partial \dot{q}_r$, where the $F(q_r)$ are the Lagrangian generalized forces for a holonomic system, is written in a number of useful forms. It is applicable to a broad field of problems including mechanical and electrical types. Two examples are given. One is dynamical and the other an electric circuit problem. L. S. G.

531.383 : 538.74 : 527 382

Repeating compasses. MAY, W. E. *Nature, Lond.*, **156**, 593–4 (*Nov.* 17, 1945).—A comparison of different types. Needle compasses are liable to errors when used in aircraft due to violent acceleration and so more complicated instruments are required. Another form of magnetic compass is the inductor type in which a coil is driven at a known speed in the earth's field; this lends itself to distant indication but is less sensitive. The gyro compass is unsatisfactory in aircraft but the gyro-magnetic compass, using a repeating magnetic compass linked to a gyroscope, smoothes out most of the erratic oscillation of the ordinary compass. Magnetic north is shown and local fields must be cancelled by "swinging" the aircraft during adjustment. E. H. W. B.

531.395 383

Equations of motion for classical dynamical systems of variable mass. GIARRATANA, J. *Phys. Rev.*, **68**, 130–41 (*Sept.* 1 *and* 15, 1945).—The various systems considered are classified, the variation of mass being caused by either a continuous deformation and

motion of the defining surface or a motion of the material points of the system, or both. A translational equation, of considerable generality, is derived which generalizes the usual equation Force = mass × acceleration. An equation is also derived which connects the moment of the external forces relative to an arbitrary fixed point and the time derivative of the angular momentum of the system relative to the same point. Various specializations of these equations are also considered. L. S. G.

531.51 : 523.112 *see Abstr.* 374

MECHANICAL MEASUREMENTS 531.7

531.717.1 : 621.317.49 384

Magnetic tester for determining the thickness of coatings on a steel base. SPENCER-TIMMS, E. S. *Metal Ind., Lond.*, 67, 298–300 (*Nov.* 9, 1945).—[Abstr. 334 B (1946).]

531.724 385

An absolute method for the determination of the area of a fine crystalline powder. HARKINS, W. D., AND JURA, G. *J. Chem. Phys.*, 13, 449–50 (*Oct.*, 1945).—[See Abstr. 2698 (1943)].

531.724 : 541.183.56 *see Abstr.* 597

531.74 : 535.8 = 4 386

Alignment projectors and the precision measurement of angles. DÉVÉ, C. *L'Optique* (*Rev. Opt. Théor. Instrum.*), 20, 115–48 (1941).—Discusses the limitations of telescopes for the measurement of small angles, then proceeds to analyse the advantages, and estimate the precision, of alignment projectors. Two types of work are discussed, the measurement of angles subtended by distant objects and the use of goniometric work in laboratories and workshops. Details are given of the instrument suited to each type of work and the various methods of use and applications are considered. These include the manufacture of precision prisms, measurement of small angles between two reflecting faces, the variation of the refractive index of the atmosphere, etc. A. H.

531.751.3 : 677 : 620.163 387

The measurement of the weight variations in cotton rovings and yarns. CAVANEY, B., FOSTER, G. A. R., AND GREGORY, J. *J. Text. Inst., Manchr*, 36, *T*197–212 (*Aug.*, 1945).—[Abstr. 221 B (1946)].

531.775 388

Hand tachometer. *Engineering*, 160, 186–7 (*Sept.* 7, 1945).—The high speeds now common in modern machinery are covered by the A.T. instrument by provision of a gear-box enabling a range of speeds from 0 to 50 000 r/m to be indicated within an accuracy of ±0·5%, and is fitted with temperature compensation for the range −25° to 45°C. Transmission of the driving spindle rotation to the indicating pointer is effected in the first stage mechanically, and in the second stage magnetically. The spindle driven by the gear box carries a worm on its other end which meshes with a pinion on the same shaft as the spur wheel which drives the rotating magnet. Actually, there is a pair of such spur wheels carried on a rocker arm, so that whichever the direction of rotation of the spindle, the magnet is rotated in a constant direction. The indicating needle is attached to a drag cup surrounding the rotating magnet, so that eddy currents in the cup produce a torque dependent on the velocity of the magnet, the torque being resisted by a hair spring. A. C. W.

531.776 + 621.822.7 + 621.317.788 389

Special testers for high precision mechanisms—torque meter, Strobotac calibrator and ball-bearing tester. WONG, L. J. *Instruments*, 18, 678–9, 712 (*Oct.*, 1945).—[Abstr. 346 B (1946)].

MECHANICS OF LIQUIDS 532

532.13 : 538.69 = 4 390

Viscosity of mercury under the influence of a magnetic field. DESTRIAU, G., AND MASSIEU, G. *C.R. Acad. Sci., Paris*, 215, 64–5 (*July* 15, 1942).—Experimental study of the viscosity of Hg in a magnetic field by the capillary method is complicated by Foucault currents. This effect was considerably diminished by employing a 0·02 mm capillary and a flow speed of 1·7 cm/sec. A maximum increase of 7% was observed in the viscosity for a magnetic field of 13 500 gauss, beyond which an apparent decrease in viscosity was observed. E. R. A.

532.133 : 541.24 391

The determination of the pressure-viscosity coefficient and molecular weight of lubricating oils by means of the temperature-viscosity equations of Vogel and Eyring. CAMERON, A. *J. Inst. Petrol.*, 31, 401–14 (*Oct.*, 1945).—The viscosity η_t of an oil at t°c can be determined from Vogel's equation $\eta_t = k \exp.\left(\frac{b}{t+\theta_t}\right)$, where k, b and θ_t are constants for any oil. From Erk and Eck's viscosity-temperature data it is shown that θ_t can be taken as 95 for almost all oils without appreciable error. The viscosity η_p at any pressure and at a given temperature t can be expressed by the exponential law $\eta_p = \eta_0 \exp.(\phi P)$, where η_0 is the viscosity at atmospheric pressure and temperature t, ϕ is a const. for any given oil at temperature t, and p is the pressure. It is shown that the product, A, of ϕ and $(t + \theta_p)$ is approximately constant, when $\theta_p = 52$. It is found possible to obtain A in terms of the temperature characteristics of the oil. Over a small temperature range it is possible to put $\theta_p = \theta_t = 73$. This gives a combined expression for η_{pt} the viscosity at any pressure and temperature. As before, A can be found in terms of b. For fatty oils $\theta_p = 85$. It appears that A is constant = 1·4 ± 18% for all fatty oils other than castor, which = 1·7 ± 10%. M the mol. wt. of an oil can be calculated from the constants in Vogel's equation by means of the empirical relation:

$$M = 0{\cdot}546(b^{1{\cdot}47} \cdot k^{0{\cdot}473})_{\theta=95}$$

532.133 : 621.892 392

A rational basis for the viscosity index system. I. HARDIMAN, E. W., AND NISSAN, A. H. *J. Inst. Petrol.*, 31, 255–70 (*Aug.*, 1945).—Various methods have been proposed for the classification of lubricating oils, but neither the Viscosity Index system, the viscosity pole height, nor the A.S.T.M. slope cover the full range completely. The viscosity index system is examined

in detail and previous attempts to overcome the anomalies are discussed. A new scheme is proposed to cover viscosity measurements made at any two temperatures over the whole of the practical range of values. Starting with the equation $\mu = A_1 e^{B/T}$ where μ = the absolute viscosity, T the absolute temperature, A_1 and B constants which may vary with temperature, an equation of the type $v_1 = kv_2^n$ is obtained. k is a function of the temperature range alone and is independent of the nature of the oil, and n is a characteristic constant of the oil and is also a function of the temperature range. Two equations are developed enabling the viscosity index to be calculated directly from measurements at 100°F and 210°F without reference to the basic data tables for the L and H series of oils. The anomalies of the earlier system are removed and it appears likely that the new system can be extended to oils having a viscosity lower than 2·0 centistokes at 210°F by the use of two other fixed temperatures. A series of tables shows the comparison of V.I. values obtained by the new method with those of Dean and Davis. E. H. D.

532.5 : 629.12.037 393

The transient performance of propellers and ships during backing and reversal. I. RÜDENBERG, R. *J. Franklin Inst.*, **240**, 193–227 (*Sept.*, 1945).—By means of streamline patterns for various ranges of operation of a propeller during stopping or reversal of a ship a detailed analysis of the phenomena concerned is developed. In contrast to the analytical formulation, the reactive forces of the propulsive jet do not change their direction on reversal of the propeller, giving the thrust-speed characteristic the form of a broken parabola. Empirical results in the literature agree with the author's conclusions. The stopping times of propeller and ship, and the headreach minimally attainable depend on a few main data relating to the machinery, propeller and ship. The behaviour of a screw propeller under reversal conditions comprises a kinematic and a dynamic component. A simple scheme leading to the development of a graphical method for solving numerically the problem of reversal is given. J. S. G. T.

532.5 = 3 394

Laminar and turbulent flow with special consideration of the effect of rigid walls. MOHR, E. *Z. Phys.*, **121** (*Nos.* 5–8) 301–50 (1943).—The expression for slip at the walls in laminar flow is derived as a direct consequence of the Maxwell mechanism of the interior friction, in consequence of which vortices always arise from the wall. Equivalent Navier-Stokes equations are established and their step-by-step solution given. The Prandtl boundary layer theory is discussed. The expression for the slip in turbulent flow corresponding to that in laminar flow is given. The number of the essential parameters and the rôle of the Reynolds number in turbulent flow are dealt with. H. G. S.

532.517.2 : 535.557 *see Abstr.* 465

532.525 : 536.782 395

The turbulent jet. HUANG, S. S. *Chinese J. Phys.*, **5**, 105–23 (*Dec.*, 1944).—Starting from the differential equations for the mean motion and the equations of double correlations for both velocity and temperature fluctuations, the mean velocity and the mean temperature distributions are calculated in the two-dimensional, in the axially symmetrical and in the half jet. In all three cases the same procedure of approximation has been followed. The results are compared with experiment and agreement is good. [See Abstr. 1318 (1945)].

532.528 : 548.73 : 620.193.1 = 3 396

Researches relating to cavitation. BRANDENBERGER, E., AND DE HALLER, P. *Schweiz. Arch. angew. Wiss. Tech.*, **10**, 331–41 (*Nov.*); 379–86 (*Dec.*, 1944).—[Abstr. 237 B (1946)].

532.542 : 628.15 = 3 397

The dimensions of hydraulic conduits. KROPF, A. *Schweiz. Bauztg.*, **125**, 229–31 (*May* 12, 1945).—Diagrams for ascertaining corresponding dimensions of, and discharges from, rough or smooth circular or egg-shaped conduits, running full or partly full and satisfying Strickler's formula are given and discussed by illustrative examples. J. S. G. T.

532.64 398

Some observations on the theory of contact angles. SCHOLBERG, H. M., AND WETZEL, W. W. *J. Chem. Phys.*, **13**, 448 (*Oct.*, 1945).

532.713 : 536.423.15 *see Abstr.* 482, 483

532.713 : 536.753 : 541.123.4 *see Abstr.* 583, 584

532.739.2 : 678 399

Physical chemical investigations of goldenrod rubber. I. SKAU, E. L., RUNCKEL, W. J., KREEGER, F. B., AND SULLIVAN, M. A. *J. Phys. Chem.*, **49**, 281–94 (*July*, 1945).—A simple titration method was developed for determining the "precipitation value" (p.v.) of a sample of rubber. This is defined as the number of ml of absolute alcohol required at a given temperature to produce a cloud point in 10 ml of a clarified benzene solution containing 0·0175 g of the sample. The p.v., which depends fundamentally on solubility, is shown to be relatively insensitive to errors in concentration. It increases progressively when the sample is degraded by treatments which decrease the viscosity, such as mastication, heating, and irradiation. P.v. and viscosities were determined on goldenrod rubber, on different kinds of natural rubber, and on binary mixtures of these and other samples of rubber partially degraded by irradiation. It is shown that the p.v.—and therefore the solubility—of a specimen is determined by the fraction of highest mol. wt. present in appreciable quantity. If used in conjunction with viscosity for the same solution, the p.v. may give information concerning the relative mol. wt. distributions in different rubber samples.

MECHANICS OF GASES 533

533.15 : 533.27 400

A note on the separation of gases by diffusion into a fast-streaming vapor. SCHWERTZ, F. A. *Phys. Rev.*, **68**, 145–6 (*Sept.* 1 *and* 15, 1945).

533.15 : 533.7 = 3 401

The diffusion thermo-effect. WALDMANN, L. *Z. Phys.*, **121** (*Nos.* 9–10) 501–22 (1943).—Starting

with the Boltzmann fundamental equation the kinetic theory of the effect is developed. The thermo-diffusion flow and the diffusion thermal flow are shown to be $\propto$ the same coefficient, the thermo-diffusion factor α. In the case of isothermal walls only the temperature-time integral, a function solely of position, can be computed with exactitude, whereas the temperature gradient of diffusion chambers with adiabatic walls is fully determined. Numerical examples are included and possible applications indicated. H. G. S.

533.15 : 537.52 = 3 402

The activation of the surface of palladium by means of the glow discharge. ULBRICH, R. *Z. Phys.*, **121** (*Nos.* 5-8) 351-76 (1943).—The activation is demonstrated by charging Pd wires to saturation with H_2 in the glow discharge at room temp. and pressures of 30–130 mm Hg. The resulting time-curve of the growth of the electrical resistance, i.e. the speed of charging, consisted of 2 straight lines followed by a curve. The lines, of which the first is inclined at a greater angle to the time-axis than the second, correspond to the regions of concentration in which solid compounds of Pd and H_2 are formed, and the curve corresponds to the solution of the gas in the metal. A Pd-tube and Ni-cylinder electrode system exhibited a much greater polarity effect than before the treatment of the Pd cathode in the glow discharge. H. G. S.

533.15 : 537.52 = 3 403

On the diffusion of inert gases in metals. LUMPE, W., AND SEELIGER, R. *Z. Phys.*, **121** (*Nos.* 9–10) 546–59 (1943).—Describes experiments on the initial distribution and the diffusion of an inert gas (Ne) in the metal (Fe) of the cathode of a glow discharge and discusses the results. H. G. S.

533.21 : 536.71 404

Empirical correction for compressibility factor and activity coefficient curves. MORGEN, R. A., AND CHILDS, J. H. *Industr. Engng Chem.*, **37**, 667–71 (*July*, 1945).

533.21 : 536.76 *see Abstr.* 488

533.22 : 53.081 = 3 *see Abstr.* 377

533.27 : 533.15 *see Abstr.* 400

533.275 : 621.315.611 405

Effect of humidity on insulation. FIELD, R. F. *Gen. Radio Exp.*, **20**, 6–12 (*July*, 1945).—[Abstr. 285 B (1946)].

533.5 406

A non-lubricated, all-glass, high vacuum valve. VAUGHAN, W. E. *Rev. Sci. Instrum.*, **16**, 254–5 (*Sept.*, 1945).

533.5 407

The hydrogen gauge—an ultra-sensitive device for location of air leaks in vacuum-device envelopes. NELSON, H. *Rev. Sci. Instrum.*, **16**, 273–5 (*Oct.*, 1945).—A sealed-off, highly evacuated ionization gauge has a section of its envelope made of thin Pd sheet which, when heated, is highly permeable to hydrogen. The gauge is attached to the manifold of a vacuum system with the Pd section isolating it from the vacuum. When the manifold or any vacuum device connected to it is probed with hydrogen, leaks in the system are indicated by an increase in the ion current of the gauge. This new technique, because it utilizes a sealed-off, highly evacuated gauge which responds only to hydrogen and is unaffected by other residual gases and vapours, provides a simple but sensitive test for very small leaks.

533.5 408

High-vacuum pumps. WITTY, R. *J. Sci. Instrum.*, **22**, 201–6 (*Nov.*, 1945).

533.56 409

Performance of diffusion pumps. HICKMAN, K. C. D. *Nature, Lond.*, **156**, 635–6 (*Nov.* 24, 1945).—[See Abstr. 2826 (1945)].

533.56 410

Comparative vacua produced by different oils in a diffusion pump. RAY, K., AND SENGUPTA, N. D. *Nature, Lond.*, **156**, 636 (*Nov.* 24, 1945).—[See Abstr. 409 (1946), 2826 (1945)].

533.7 : 533.15 = 3 *see Abstr.* 401

ACOUSTICS . VIBRATIONS 534

534.121.2 : 621.395.623.73 411

The conical sound source. BORDONI, P. G. *J. Acoust. Soc. Amer.*, **17**, 123–6 (*Oct.*, 1945).—[See Abstr. 2136 (1941), 2736 (1943)]. An asymptotic expansion has been derived which allows the plotting of directional and response curves for a vibrating cone in an infinite baffle. The results are compared with those pertaining to a flat disc of the same radius.

534.13 : 629.113 : 620.178.322 412

A vibration investigation. MULLER, L. E. *Mech. Engng, N.Y.*, **67**, 723–8 (*Nov.*, 1945).—[Abstr. 230 B (1946)].

534.131 : 621–233 : 629.135 413

Coupled engine torsional and propeller flexural vibrations. MORRIS, J. *Proc. Instn Mech. Engrs, Lond.*, **135** (*War Emerg. Issue No.* 3) 41–60 (1945).—An analytical method is given for the determination of coupled engine torsional and propeller flexural vibrations, in which account is taken of blade section, blade twist, hub moment of inertia, pitch setting angle, and speed of rotation. The propeller blade is divided chordwise into 6 portions which are regarded as having their masses concentrated at their centres of gravity, while account is taken, as far as possible, of the actual elastic properties of the blade. In the case of an aircraft propeller, the problem is simplified in that the mass axis is practically straight and coincident with the flexural axis, so that flexural and torsional vibrations of the blade itself are not coupled. The theory was applied to a 3-blade propeller used on two different engines, in both of which agreement between the calculated critical speeds and those observed experimentally on the cable hangar was found to be satisfactory. The calculated fixed root frequencies for the fundamental and 6 overtones accorded very closely with the corresponding values evidenced on a $^1/_{10}$-scale model of the blade by bowing and calibrated oscillator tests.

534.142.4 414
Addendum on singing flames. JONES, A. T. *J. Acoust. Soc. Amer.*, **17**, 151 (*Nov.*, 1945).—[See Abstr. 2204 (1945)].

534.2 = 3 415
The theory of the spherical wave excited at finite distance from the plane of separation of two media of finite refractive index. KRÜGER, M. *Z. Phys.*, **121** (*Nos.* 5–8) 377–437 (1943).—For a source of radiation of spherical waves situated in one medium at a finite distance from the boundary layer of a second, exact asymptotic solutions are derived of the potential function in both media for finite complex and real indices of refraction. The results are for distances large in relation to the wavelengths. Weyl's method of transforming complex double integrals is used in the solution of the problem. [See Abstr. 622 (1943)].
H. G. S.

534.213.4 416
The theory of the Herschel–Quincke tube. STEWART, G. W. *J. Acoust. Soc. Amer.*, **17**, 107–8 (*Nov.*, 1945).—A former discussion [see Abstr. 2782 (1928)] of the theory of the Herschel–Quincke tube is continued and supplemented by the investigation of a more general case. With the areas of the bifurcated conduits different, it is found that the number of frequencies giving zero transmission is again more numerous than determined by the condition of a difference of phase corresponding to that of one-half wavelength in the two branches. In the more general case the former fixed relations between these phase differences no longer holds. They are now connected by the equality $S_2 \sin \alpha_3 = -S_3 \sin \alpha_2$, where S_2 and S_3 are the areas and α_2 and α_3 the phase differences in the corresponding branches.

534.213.4 417
Attenuation of sound in circular ducts. FISHER, E. *J. Acoust. Soc. Amer.*, **17**, 121–2 (*Nov.*, 1945).

534.22.093.094 : 534.321.9 *see Abstr.* 418

534.222 : 535.232 = 4 *see Abstr.* 431

534.321.9 : 534.22.093.094 418
Supersonic dispersion in gases. II. Air containing water vapour. MOKHTAR, M., AND RICHARDSON, E. G. *Proc. Roy. Soc. A*, **184** (*No.* 997) 117–28 (*Aug.* 21, 1945).—The apparatus and method of measurement used is described [Abstr. 3361 (1934)]. Curves are given showing the variation, at various frequencies, of the supersonic absorption coefficient, μ, and the supersonic velocity with the water vapour pressure. The results deduced are: (1) The velocity in dry air is independent of frequency [Abstr. 1756 (1937)]; (2) The measured values for μ in dry air are several times larger than those calculated from the Stokes–Kirchhoff formula, and indicate an approximately linear dependence on the frequency; (3) In humid air μ reaches a maximum, two or three times its value in dry air, at a vapour pressure which decreases as the frequency increases; (4) The maximum of dispersion in velocity decreases as the frequency increases.
L. S. G.

534.321.9 : 534.614 419
Measurement of ultrasonic velocities in extended solids. PARSHAD, R. *Nature, Lond.*, **156**, 637 (*Nov.* 24, 1945)].

534.321.9 : 591.185.5 420
Acoustic control in the flight of bats. HARTRIDGE, H. *Nature, Lond.*, **156**, 490–4 (*Oct.* 27, 1945).—[See Abstr. 1745 (1945)]. Bats undoubtedly emit sounds of more than one frequency and it is stated that four different kinds of sound are produced, i.e. (1) A buzz, observable only at close quarters. (2) The signalling tone of about 7 000 c/s, usually having a duration of about $\frac{1}{4}$ sec. (3) The supersonic tone which is usually in the range 40–50 kc/s. This sound can be emitted at rest and in flight; it may be emitted in single pulses of about 0·01 sec, or a number of such pulses may be produced. At rest the number may be 5–10 per sec, but in flight it increases to 20–30 per sec. (4) A click. Physical characteristics connected with the production of these sounds and with the hearing of bats are discussed and a brief comparison is made with radar. In the latter the wavelength goes down to 1 cm and in the bat it is about 0·7 cm. The bat has the further advantage of stereophonic reception to aid in the location of obstacles.
E. H. D.

534.321.9 : 591.185.5 421
Acoustic control in the flight of bats. EWER, D. W., HARTRIDGE, H., AND WILKINSON, M. *Nature, Lond.*, **156**, 692–3 (*Dec.* 8, 1945).—[See Abstr. 420 (1946)].

534.37 : 538.23 : 538.65 = 3 *see Abstr.* 538

534.614 : 534.321.9 *see Abstr.* 419

534.77 422
Aero-otitis media in submarine personnel. HAINES, H. L. *J. Acoust. Soc. Amer.*, **17**, 136–8 (*Oct.*, 1945).

534.771 423
Auditory acuity in severe aero-otitis media. HARRIS, J. D. *J. Acoust. Soc. Amer.*, **17**, 139–43 (*Oct.*, 1945).

534.773.2 : 389.64 424
Tentative code for measurement of performance of hearing aids. *J. Acoust. Soc. Amer.*, **17**, 144–50 (*Oct.*, 1945).

534.845 = 3 425
Acoustic examination of partitions for Zürich school buildings. FURRER, W., AND HALLER, P. *Schweiz. Bauztg.*, **125**, 102–5 (*March* 3, 1945).—Shortage of metals has necessitated the use of other materials in the construction of school buildings and this has introduced problems of sound insulation. Walls and ceilings have to offer satisfactory resistance to general noise and also to footsteps. Various different constructions have been examined experimentally, by the usual acoustic methods in which a source of sound and a suitable receiver are placed on opposite sides of the partition. Results are given in terms of db and phons, and variations with frequency are shown graphically. The materials examined include parquet flooring, plaster, glass silk mats, glass wool, roofing felt, etc.
E. H. D.

OPTICS . RADIATION . SPECTRA 535

535.11 = 4 426

Emission from the ends of luminous tubes. DUNOYER, L. *Rev. Opt.* (*Théor. Instrum.*), **18**, 233–50 (*Aug.–Sept.*, 1939).—Continuing earlier work [see Abstr. 1155, 1156 (1939)] a study is made of the total emission from the end of a cylindrical tube containing a fluid emitting light because of electro- or photo-luminescence. The treatment is entirely mathematical in character. A. H.

535.13 : 535.42 *see Abstr.* 463

535.13 = 82 427

The electromagnetic theory of light. *Publ. Moscow State Univ.*, 32 *pp.* (1944).—A review of work in the James Clerk Maxwell Laboratory at Moscow University during the years 1919–44.

535.13 : 538.1 = 4 428

Maxwell's equations and series of vortices. REULOS, R. *Rev. Gén. Élect.*, **48**, 325–36 (*Dec.*, 1945).—An unusual nomenclature is used in that the vector curl A of the field vector A is called the vortex of the field. Properties of a series of vortices are studied, the series being given by

$$\text{curl } A_0 = 0,\ \lambda A_n = \text{curl } A_{n+1} \quad (n = 0, 1, 2, \ldots)$$

Examples of such are given, one of these relating to the field of a dipole. A new method of integrating Maxwell's equations by means of a series of vortices is given, and it is shown how the method may be used to calculate the magnetic and electric fields due to a moving electron. L. S. G.

535.14 : 535.215 *see Abstr.* 429

535.215 : 535.14 429

Quantum mechanical theory of the Joshi effect. TIWARI, G. S., AND PRASAD, B. N. *Curr. Sci.*, **14**, 229–30 (*Sept.*, 1945).

535.23/.24 430

Note concerning the maximum luminous efficiency of radiant energy. MACADAM, D. L. *J. Opt. Soc. Amer.*, **35**, 615–16 (*Sept.*, 1945).—Discusses the various values of the max. luminous efficiency of radiant energy which have been derived by various authors and the effects of changes of the radiation constants. J. W. T. W.

535.232 : 534.222 = 4 431

Distribution of energy in the light emitted on the encounter of shock waves. MICHEL-LÉVY, A., MURAOUR, H., AND VASSY, E. *L'Optique* (*Rev. Opt. Théor. Instrum.*), **20**, 149–60 (1941).—An examination is made of the distribution of energy in the continuous spectra obtained when shock waves meet in an atmosphere of argon, helium or oxygen. Comparison is made photographically with the radiation emitted by a source for which the distribution is known (positive crater, C arc). It is shown that the radiation is not black body radiation and no explanation of the mechanism of the phenomena can be suggested. A. H.

535.24 432

Transmission of light from a point source in a medium bounded by diffusely reflecting parallel plane surfaces. BATEMAN, H., AND PEKERIS, C. L. *J. Opt. Soc. Amer.*, **35**, 651–7 (*Oct.*, 1945).—A calculation is made of the total luminous flux incident upon a spherical receiver situated within the medium. A pair of simultaneous integral equations occurs in the analysis and these are solved exactly by means of a Hankel inversion. The expression for the illumination of the receiver is analysed in terms of multiple reflections and is transformed into a form suitable for numerical computation. The results of some calculations are given in graphical form. The bounding surfaces are assumed to reflect according to Lambert's law but the method of solution is applicable when this does not hold. L. S. G.

535.241.4 : 621.327.43 433

Some physical properties of fluorescent lamp coatings. THAYER, R. N. *Trans. Electrochem. Soc.*, **87** (*Prepr.* 25) 15 *pp.* (1945).—[Abstr. 365 B (1946)].

535.241.431 : 628.9.04 = 4 434

Design of electric lighting installation for a circular or semi-circular area. PÉCHEUX, H. *Rev. Gén. Élect.*, **51**, 67–73 (*Jan.*, 1942).—Examines various methods of obtaining an even illumination over a circular or semi-circular area and finds that for the former the best arrangement consists of tubular sources, four in number and occupying altogether one-half the circumference of a circle whose radius is $^3/_4$ that of the area to be illuminated. For a semi-circular area, the tubes should occupy half the semi-circumference of a circle with $^5/_8$ the radius. The calculations leading to these results are given. J. W. T. W.

535.243 : 551.57 *see Abstr.* 625

535.245 : 778.3 : 551.521.11 *see Abstr.* 623

535.247.4 : 525.75 = 4 435

Automatic recording photoelectric photometer for the study of the night sky and twilight. GRANDMONTAGNE, R. *Rev. Opt.* (*Théor. Instrum.*), **19**, 78–85 (1940).—A description is given of the instrument which is adjustable for both azimuth and altitude. By means of a set of 8 filters, which move past automatically, the variation throughout the night over 8 different spectral regions may be recorded. A. H.

535.247.4–31 436

An ultraviolet intensity meter for field use. ANDREWS, H. L. *Rev. Sci. Instrum.*, **16**, 253–4 (*Sept.*, 1945).—Uses a photocell with Ta cathode, which has max. output at 2 300 Å and zero at 3 000 Å. It can thus be used in the presence of daylight. Readings are made by a null method, using a battery-operated valve circuit and microammeter.

535.249 : 621.326 = 4 437

Measurement of the flickering of lamps supplied with alternating current. BRICOUT, P. *L'Optique* (*Rev. Opt. Théor. Instrum.*), **20**, 26–34 (1941).—An attempt is made to get a measure of the flickering of lamps fed with low frequency alternating current. Whilst there are two general cases, the effect on stationary and on moving objects, attention is concentrated on the first of these. The coefficient of scintillation is given as $S = \dfrac{e_{max} - e_{min}}{e_{max} + e_{min}}$ where e denotes the brightness of the filament. It is shown that S may be

obtained by direct measurements of e, but details are given of an apparatus incorporating a photoelectric cell and a pentode whereby S may be measured directly. This photometer requires calibration against a source flickering in a known manner. It is found that flickering in the case of lamps fed with a.c. is most noticeable when the illumination is ~50–100 lux, that the threshold for detection by the eye is a function of the frequency ($S = 0{\cdot}13$ at 50 c/s), and that above 100 c/s no flickering is observable even for $S = 1$. It is shown that the spiral filament lamp produces much less flickering than do the other types. A. H.

535.313 = 4 438

Multiple reflection of light in cylindrical tubes. SERVANT, R. *Rev. Opt. (Théor. Instrum.)*, **19**, 218–20 (1940).—A number of simple experiments are described. Some applications are suggested, e.g. the measurement of the internal diameters of tubes or the variation of reflectivity with temperature. A. H.

535.315 : 535.42 439

Focal plane anomalies in roof prisms. MAHAN, A. I. *J. Opt. Soc. Amer.*, **35**, 623–45 (*Oct.*, 1945).—When parallel light passing through the prism is brought to a focus by a lens a doubling of the image is observed in a direction perpendicular to the roof edge, while parallel to the roof edge the image remains single and sharp. If plane polarized light is used, the form of the doubling can be changed by rotating the incident azimuth angle. Usually in roof prisms, such a doubling is due to a roof angle error. The paper shows that such is not the case for this particular prism, and suggests that all roof prisms can be expected to possess to some degree the same characteristic. The magnitude of the doubling in unpolarized light and the changes in polarized light when the plane is rotated are shown to be a function of the geometry of the prism and its refractive index.

535.316 : 535.42 = 4 440

Establishment of the formula for thin lenses by means of diffraction theory. BOUTARIC, A. *Rev. Opt. (Théor. Instrum.)*, **19**, 74–7 (1940).

535.317.7 441

A method for the measurement of the energy distribution in optical images. JONES, L. A., AND WOLFE, R. N. *J. Opt. Soc. Amer.*, **35**, 559–69 (*Sept.*, 1945).—The image of a line source ($0{\cdot}002$ in slit at a distance of about 35 × the focal length of the system) is enlarged by a microscope and projected on to a photographic plate through a neutral carbon wedge varying in density in a direction parallel to the length of the image. The energy profile across the image is thus recorded on the plate. For each off-axis position, a record is made with the line source tangential and radial. Information on the sharpness of a line image is of greater practical importance than of a point image for photography of terrestrial objects. Edge diffraction patterns can be measured by a variation of the method. Sources of error and methods of calibration are discussed.

535.33.03 : 535.89 = 4 442

Hydrogen lamps. DÉJARDIN, G., AND CAVASSILAS, D. *Rev. Opt. (Théor. Instrum.)*, **18**, 251–61 (*Aug.–Sept.*), 1939.—Details are given of two lamps suitable for the production of the hydrogen molecular continuum. The more powerful lamp takes 2 A at 2 900 V, the other 300–500 mA at 900 V. Constructional details are given together with curves of the distribution of spectral energy. Notes on the behaviour of the two lamps are also included. A. H.

535.331 : 538.615 443

Zeeman effects in the arc, first spark, and second spark spectra of yttrium. MCNALLY, J. R., JR., AND HARRISON, G. R. *J. Opt. Soc. Amer.*, **35**, 584–96 (*Sept.*, 1945).—Exposures to the yttrium arc in silver at fields of 85 000 oersteds yielded interpretable Zeeman effects of the first three spectra—Y I, Y II, Y III. Zeeman patterns arising from transitions between energy states of the doubly-ionized atom were observed in the range 2 950–2 360 Å. Landé g factors were calculated for the $4d$, $5s$ and $5p$ energy levels. Magnetic splitting of lines in the first spark spectrum of Y permitted the determination of g values for 59 of the 61 known energy levels. Zeeman effects of the arc lines of Y were observed for lines of high intensity only. Overall g sums pertaining to the singly-ionized atom verify the g-sum rule exceptionally well in spite of large variations of individual g values from the theoretical Ls values. Term classifications were verified in the majority of cases.

535.331 : 538.615 *see Abstr.* 537

535.338 : 539.13 444

Special cases of predissociation. ROSEN, B. *Phys. Rev.*, **68**, 124–6 (*Sept.* 1 *and* 15, 1945).—A study of the AlO spectrum indicates that a predissociation of the type one b takes place in the lower electronic state of the green system. It is suggested that the γ- and ε-bands of NO do not belong to a single system; the γ system shows a strong perturbation of the $v' = 4$ level. An accidental predissociation of the vibrational type is found in the spectrum of Te_2, and the analogy of the three molecules S_2, Se_2 and Te_2 is strengthened.

535.338.334 445

General theory of pressure broadening of spectral lines. JABLOŃSKI, A. *Phys. Rev.*, **68**, 78–93 (*Aug.* 1 *and* 15, 1945).—A close analogy to the theory of intensity distribution in molecular spectra is shown. Both phenomena are due to the relative movements of atomic nuclei. The method of James and Coolidge for the calculations of intensity distribution in H_2 and D_2 continuous spectra can be adapted to the calculations of the profiles of broadened lines. In this case it will not be possible to represent the intensity distribution in a closed form. In order to obtain a closed form, Condon's method is applied, and the Wentzel-Kramers-Brillouin approx. eigenfunctions are used for nuclear motions. The limitations of this approximation are discussed. Because of the simplifications, the resulting intensity distribution formula must be considered as asymptotic only, valid in a restricted region of frequencies of the broadened line and only in the case of heavy atoms and high temperatures.

535.338.334 : 537.228.5 446

Splitting of the sodium doublet lines. TAWDE, N. R., PATIL, B. S., AND MEHTA, G. K. *Nature, Lond.*, **156**,

662–3 (*Dec.* 1, 1945).—Each of the lines from a Na vapour lamp was observed to be split when the lamp arrived at its working temperature. This might be due to self-reversal combined with pressure broadening; but it is believed to be a Stark effect caused by foreign perturbers (here Ne) carrying permanent fields.

535.338.4 447

The bands of PO molecule. RAMANADHAM, R., AND RAO, G. V. S. R. *Curr. Sci.*, **14**, 230 (*Sept.*, 1945).

535.338.4 = 3 448

On the band spectrum of silver hydride. GERÖ, L., AND SCHMID, R. *Z. Phys.*, **121** (*Nos.* 5–8) 459–87 (1943).—The AgH band spectrum is rephotographed and 60 bands of the $^1\Sigma - {}^1\Sigma$ system are analysed. The vibration term distances and the rotation constants of the lower electron terms are calculated. The strongly homogeneous perturbation of the upper state is analysed by the method of the *B′–B″* curves. The results are given in tables and curves. H. G. S.

535.338.4–31 449

Ultra-violet band systems of the mercury iodide molecule. I. RAO, K. R., SASTRY, M. G., AND KRISHNAMURTI, V. G. *Indian J. Phys.*, **18**, 323–32 (*Dec.*, 1944).—[See Abstr. 2241 (1945)]. The bands were photographed with a Hilger large quartz Littrow spectrograph. The systems *C* and *D* lying in the regions λ3100–λ2800 and λ2800–λ2650 were measured. The wavelengths of the *C* system were compared with those published by Wieland, the data obtained in the system *D* being entirely new. The vibrational constants obtained are in agreement with the values determined approximately by Wieland from the study of fluorescence of HgI, but the origin of the *D* system is different from that suggested by Wieland. With the classification obtained in the present work, the systems could be attributed to the two components of a $^2\Pi_{\pi}-{}^2\Sigma$ electronic transition with a $^2\Pi$ interval of 3 538 cm^{-1} which is shown to be in conformity with the corresponding intervals obtained for the other mercury halides, HgF and HgCl.

535.338.4–31 450

On the ultra-violet bands of K. SINHA, S. P. *Curr. Sci.*, **14**, 230–1 (*Sept.*, 1945).

535.339 451

Double monochromators for the visible and ultra-violet regions. FRAUDET, G., AND VODAR, B. *Rev. Opt.* (*Théor. Instrum.*), **19**, 49–67 (1940).—Examines the principles underlying the construction of double monochromators and surveys the types available, with subtractive or with additive dispersion. The use of mirrors and special types of prism is discussed. Details are given of a simple form of van Cittert monochromator of the first type, with achromatic collimation. The performance at various wavelengths (down to λ2280) is examined. A. H.

535.34 : 535.563–31 = 4 452

Apparatus and methods for the rapid study of absorption and optical activity in the ultra-violet. GESTEAU, P. *Rev. Opt.* (*Théor. Instrum.*), **19**, 113–22 (1940).—Adapts apparatus due to Yvon by adding a polarizer and analyser, the former being turned by a motor which also raises or lowers the photographic plate. For absorption, two identical blackenings are aimed at, one by passage of radiation through the absorbing substance, the other by reducing the luminous flux by a known fraction. This is achieved by the turning of the polarizer. A. H.

535.343 453

Theory of the ultraviolet absorption spectrum of diphenyl. LONDON, A. *J. Chem. Phys.*, **13**, 396–428 (*Oct.*, 1945).—The lower excited energy levels of the molecule diphenyl are calculated by the method of antisymmetrized products of molecular orbitals. The wave functions for diphenyl are constructed from linear combinations of benzene molecular orbitals and the perturbation of the original energy levels of benzene caused by the presence of the second benzene ring in diphenyl is computed. The theory predicts the splitting of the two non-degenerate singlet levels and the one degenerate singlet level of benzene into 8 levels, 4 of which give allowed electronic transitions to the ground state and 4 of which do not. Experimentally three strong structureless bands are observed, one between 2 200 Å and 2 800 Å, one at about 1 900 Å and one below 1 700 Å. The calculated spectrum has allowed transitions at about 2 400 Å, 1 900 Å, 1 500 Å and 1 400 Å, and thus is in good agreement with the experimental observations.

535.343 : 539.153 *see Abstr.* 542

535.343–1 : 541.64 454

The infra-red spectra of polymers and related monomers. I–II. THOMPSON, H. W., AND TORKINGTON, P. *Proc. Roy. Soc.A*, **184**, 3–20, 21–41 (*July* 23, 1945).—An experimental method is described for producing the spectra of polymers which were usually examined in thin solid films. A survey is made of the spectra of the hydrocarbon-type polymers, e.g. polythene, polyisobutylene, buna, hydro-rubber, polystyrene and compounds related to these. The existence of methyl groups and a small number of carbonyl groups in polythene is revealed. The type of unsaturated products formed during the cracking of polythene is indicated. A study is made of the variation of spectrum with chain length and of the influence of the state of aggregation. In II the spectra of some polymers containing Cl_2 are measured. Vibrational analyses and a study of band contours with vinyl chloride and bromide, and vinylidene chloride and bromide have enabled magnitudes to be assigned to many of the normal vibration frequencies. The rotational structure associated with some of the vibration bands is discussed in relation to the molecular structure. Similar considerations are applied to chloroprene. The spectra of polyvinyl chloride, polyvinylidene chloride, and some halothenes and neoprenes are also examined. L. S. G.

535.343.4 455

Relative *f*-values of potassium atom. NANDA, J. N. *Indian J. Phys.*, **19**, 8–19 (*Feb.*, 1945).—Principal series lines of K have been studied in absorption. Construction details for the high intensity hydrogen discharge tube as a source for ultraviolet light, and a sensitive intensity reducing device are given. The *f*-value of the first line relative to the second varies with the conditions of experiment from 16·1 to 6·4;

the theoretical value is 91·5 and experimental value from anomalous dispersion (Hook method) is 98·5. The low values obtained from the present direct method need clarification. On the photographic plates, in addition to the atomic lines, strong molecular bands also appear, though the expected number of K_2 molecules is only 3 to 4% of the total vapour present. There is no sudden drop of intensity from the fourth to fifth lines as given by theory, but the intensity does not decline smoothly with the series number. Some lines show slightly greater intensity than the preceding ones (e.g. 10th and 13th). The continuum at the head of the series limit shows a broad minimum at about 2 700 Å, the absorption increasing towards shorter wavelengths. This anomaly has also been reported by others.

535.343.4 456

Study of the absorption spectra of mercury vapour with varying temperature and pressure. BHATTACHARYYA, D. K., AND MURARI, J. *Indian J. Phys.*, **19**, 20–3 (*Feb.*, 1945).—An absorption chamber of fused quartz was used, with a hydrogen continuum as the background. Progressive broadening of the absorption line λ2537 Å both with increasing temperature and pressure was observed. Also a few new bands near the absorption line λ2537 Å were observed. The absorption bands between λ2311 Å and λ2341 Å were observed to develop and grow clearer with increasing pressure at 560°C and 800°C, while they did not appear at all at 250°C.

535.345 : 614.485 : 621.327.311 457

Disinfection with germicidal lamps. III. LUCKIESH, M. *Elect. World, N.Y.*, **124**, 90–1 (*Oct.* 27, 1945).—[Abstr. 363 B (1946)].

535.345.6 : 535.6.07 *see Abstr.* 467

535.375.54/.55 458

On the Raman spectra of ethylene dibromide and dichlorethylene in the solid state. SIRKAR, S. C., AND BISHUI, B. M. *Indian J. Phys.*, **19**, 24–33 (*Feb.*, 1945).—The Raman spectra of ethylene dibromide and mixture of *cis* and *trans* dichlorethylene in the solid state at −170°C were studied and compared with those for the liquid state. The polarization of the Raman lines of ethylene dibromide in the liquid state were also studied. Two of the intense Raman lines of liquid ethylene dibromide which ought to have been polarized according to the hypothesis put forward by Mizushima and Morino [*Proc. Indian Acad. Sci. A*, **8**, 315 (1938)] are actually depolarized. A new explanation that the liquid state of ethylene dibromide consists of pairs of *cis* molecules forming a configuration having a symmetry C_{2v} is offered and its advantages over the former one are discussed. It is assumed that in the solid state the configuration changes to have the symmetry of the point group D_{2h}, and the observed variation of the permanent electric moment with change of state is also explained on this hypothesis.

535.39 459

An exact theoretical treatment of reflection-reducing optical coatings. MOONEY, R. L. *J. Opt. Soc. Amer.*, **35**, 574–83 (*Sept.*, 1945).—Exact formulae for the reflectivity, *R*, and transmissivity, *T*, are obtained by means of a boundary value problem based on Maxwell's equations. A formula for minimum reflectivity for a monolayer coating is obtained and the conditions for zero reflectivity are described. Next is the problem of a beam of light normally incident upon a plane surface of a transparent medium covered by two transparent homogeneous films of different thicknesses and refractive indices. Formulae for *R* and *T* are derived. A maximum of *T* is obtained when the thickness of each coating is $\lambda/4$ (λ = wavelength). Graphs of the results are given and a comparison is made with the approximate results of other authors [Abstr. 174 (1944), 2116 (1940), 3926 (1937). Curves are plotted showing the reflectivity as a function of λ.

L. S. G.

535.41 = 4 460

Harmonic analysis of interference fringes. DUFFIEUX, P. M. *Rev. Opt. (Théor. Instrum.)*, **18**, 273–82 (*Oct.–Dec.*, 1939).—Continuing earlier work [see Abstr. 2781 (1940)] details are given of a method for interference fringe calculations for apparatus with imperfect optics. The method is based upon the relation between the brightness of the fringes localized in the film of air and those located at infinity given by the same film. The effects of various defects are discussed. A. H.

535.41 = 4 461

Superposition fringes for optical etalons with parallel faces. CABRERA, N., AND TERRIEN, J. *L'Optique (Rev. Opt. Théor. Instrum.)*, **20**, 35–46 (1941).—An extensive theoretical study is made of the superposition fringes and rings obtainable at infinity using two etalons. The effects obtained, as the path difference and thickness of etalons is changed, are discussed mathematically and the application of the results to problems such as the determination of small differences in the evaluation of the standard metre is examined.

A. H.

535.412 462

Haidinger interference fringes in plane-parallel crystalline plates. BILLINGS, B. H. *J. Opt. Soc. Amer.*, **35**, 570–3 (*Sept.*, 1945).—The Haidinger interference fringes obtained when convergent unpolarized light passes through a half-silvered mica plate have already been demonstrated by Pfund [see Abstr. 3048 (1942)]. In this article the mathematical theory governing the phenomenon is developed. A. H.

535.417 : 549.514.51 : 548.572 *see Abstr.* 609

535.417 : 549.623.5 : 548.572 *see Abstr.* 610

535.42 : 535.13 463

The theory of diffraction. PIDDUCK, F. B. *Phys. Rev.*, **68**, 142 (*Sept.* 1 *and* 15, 1945).

535.42 : 535.315 *see Abstr.* 439

535.42 : 535.316 = 4 *see Abstr.* 440

535.43 : 539.37 : 537.531 *see Abstr.* 510

535.434 464

Inversion of low angle scattering data for particle size distribution. BAUER, S. H. *J. Chem. Phys.*, **13**, 450–1 (*Oct.*, 1945).

535.434 : 535.65 = 4 *see Abstr.* 468

535.52/.54 : 548.0 : 549.12 = 4 *see Abstr.* 621

535.54 : 548.0 = 3 *see Abstr.* 606

535.557 : 532.517.2 465

Birefringence of polyisobutylene in solution and the Frenkel theory of macromolecular rupture. REHNER, J., JR. *J. Chem. Phys.*, **13**, 450 (*Oct.*, 1945).

535.563 = 4 466

Optical activity of camphor cyanide in the visible and ultra-violet regions. MATHIEU, J. P., AND RONAYETTE, M. *Rev. Opt.* (*Théor. Instrum.*), **19**, 1–26 (1940).—Describes a method for measuring optical activity as far as 2 500 Å and the application of this to camphor cyanide in various solvents. Curves for circular dichroism and rotatory dispersion are analysed. The nature of the molecular forms present in solution is discussed. A. H.

535.563–31 : 535.34 = 4 *see Abstr.* 452

535.6.07 : 535.345.6 467

Colorimetric specifications of Wratten light filters. MACADAM, D. L. *J. Opt. Soc. Amer.*, **35**, 670–5 (*Oct.*, 1945).—Colorimetric specifications are given for Wratten light filters, including the tristimulus values, trichromatic co-ordinates, dominant wavelengths, purity and luminous transmittance for ICI illuminants *A* and *C* and for an artificial daylight produced by the use of a Wratten filter. These data are based on the spectral transmittance values published in the seventeenth edition (1944) of the booklet entitled "Wratten Light Filters." Wavelengths for thirty selected ordinates and for supplementary ordinates are given for colorimetric computations involving the artificial daylight source, which consists of a tungsten filament lamp operated at a colour temperature of 2 360°K, the light from which is passed through a Wratten filter No. 78.

535.65 : 535.434 = 4 468

Colorimetry of turbid media. DOGNON, A. *Rev. Opt.* (*Théor. Instrum.*), **19**, 205–12 (1940).—Details are given of a simple method for evaluating the turbidity of a solution, whether coloured or not, and of allowing for this in colorimetric work. A colorimeter incorporating an integrating sphere is described by means of which results independent of turbidity can be obtained. A. H.

535.663 = 4 469

The colour of bodies by reflected light. III. Effect of surface condition. AMY, L. *Rev. Opt.* (*Théor. Instrum.*), **19**, 68–73 (1940).—Continuing earlier work [see Abstr. 3518 (1937)] a study is made of the modification produced in the colour of a body by the condition of the surface, this part being limited to the case of a surface rough enough to diffuse practically the whole of the reflected light. It is shown that if ρ is the albedo for a given λ, the curve for the quantity $\rho^{-1} - 1$ plotted against λ has the same shape for different conditions of the surface. A given condition can thus be characterized by a quantity ϕ independent of λ. A. H.

535.733 : 612.84 *see Abstr.* 632

535.733.1 470

Notes on "A photo-receptor mechanism for the modulation theory of colour vision" by G. A. Fry. MACADAM, D. L. *J. Opt. Soc. Amer.*, **35**, 616–17 (*Sept.*, 1945).—Corrects certain erroneous conclusions in the paper mentioned. [Abstr. 1781 (1945)]. These corrections are accepted by Fry in a letter on p. 617. J. W. T. W.

535.767 = 4 471

On the perception of the external world by monocular or binocular vision, with or without instruments. DUNOYER, L. *Rev. Opt.* (*Théor. Instrum.*), **19**, 177–90 (1940).—Discusses a number of points in connection with monocular and binocular vision, especially in connection with the use of instruments. The improved relief and ability to estimate distance given by binocular instruments is considered. The underlying theory is considered at length. A. H.

535.767 = 4 472

The sensation of relief and its interpretation by the subconscious mind. DÉVÉ, C. *Rev. Opt.* (*Théor. Instrum.*), **19**, 191–204 (1940).—A survey article which deals, mainly from the physiological viewpoint, with the phenomena of stereoscopic vision. The topics considered include the effect of memory, optimum distance, the effect of lighting and motion on the effect produced, selective neutralization (whereby the eye can ignore intervening planes). Some consideration is given to the mechanism of the effect with a view to instrumental applications. A. H.

535.767 : 535.88 473

A stereo-episcope. CURTIS, W. E., AND LITTLEFIELD, T. A. *J. Sci. Instrum.*, **22**, 215–18 (*Nov.*, 1945).—The stereo-episcope projects images of a stereoscopic pair with a magnification of three upon a special screen and they are seen in stereoscopic relief by use of either Anaglyph or Polaroid filters and spectacles. Details of the optical system, the mechanical remote controls and the adjustment procedure are described.

535.8 : 531.74 = 4 *see Abstr.* 386

535.8 : 771.35 = 4 *see Abstr.* 640

535.81 = 4 474

Notes on the optics of organic glasses. BOUTRY, G. A. *L'Optique* (*Rev. Opt. Théor. Instrum.*), **20**, 5–25 (1941).—After an examination of the optical, physical and mechanical properties of some synthetic resins, details are given of the methods employed for producing lenses, flats, mirrors and filters from these materials by moulding. Powers of up to 6 dioptres are obtained and radii of curvature down to 40 mm. The advantages and disadvantages as compared with normal types of glass are discussed at length, the points considered being poor mechanical strength, liability to scratch, high expansion and transmission coefficients, transparency outside the visible spectrum. A full discussion is given of the effect of variable polymerization (due to pressure employed in moulding) and the internal strain produced as a result of this. It is emphasized that reproducibility as regards refractive index and dispersion is very good. A. H

535.822.4 : 541.18 = 3 *see Abstr.* 591

535.822.4 : 541.182.5 *see Abstr.* 592

535.823.1 = 4 475

New microscope stand for photo-micrography. JEANTET, P. *Rev. Opt. (Théor. Instrum.)*, **19**, 27–35 (1940).—Comments upon the difficulty experienced in microphotography because of vibration due to passing vehicles, machinery, etc., transmitted through the earth. Full details are given of the instruments and technique developed at the Pasteur Institute, one of the main features being the horizontal arrangement of the microscope and camera. A. H.

535.88 : 535.767 *see Abstr.* 473

535.89 : 535.33.03 = 4 *see Abstr.* 442

535.89 : 778.3 = 4 476

Short duration source for photographic use. MURAOUR, H., MICHEL-LÉVY, A., AND VASSY, E. *L'Optique (Rev. Opt. Théor. Instrum.)*, **20**, 161–5 (1941).—Details are given of a new source for photographing phenomena of extremely short duration. Shock waves in a rare gas atmosphere (Argon) produce a flash of duration 3 to 4×10^{-6} sec and of between $1 \cdot 5$ and 6×10^8 c.p. Constructional details are given of two models together with details of the method of detonation. [See Abstr. 431 (1946)]. A. H.

HEAT . THERMODYNAMICS 536

536.2.01 = 3 477

Difference method for solving the differential equation of non-stationary thermal conduction in the case of two-dimensional heat flow. ELSER, K. *Schweiz. Arch. angew. Wiss. Tech.*, **10**, 341–3 (*Nov.*, 1944).

536.21 478

Heat-flux pattern in fin tubes under radiation. MUMFORD, A. R., AND POWELL, E. M. *Trans. Amer. Soc. Mech. Engrs*, **67**, 693–5 (*Nov.*, 1945).—Data are presented showing heat-flux patterns as indicated by temperature-drop curves from field measurements and from an electrical analogy in the laboratory. Data of this kind may be important if the use of tube-surface temperatures in furnace-testing technique is developed.

536.212.3 : 662.998 479

The thermal insulation of structures. GARD, J. S. F. *Fuel Econ. Rev.*, **24**, 37–44 (1945) —[Abstr. 465 B (1946)].

536.413 : 679.5 480

Thermal expansion and second-order transition effects in high polymers. II. Theory. BOYER, R. F., AND SPENCER, R. S. *J. Appl. Phys.*, **16**, 594–607 (*Oct.*, 1945).—[See Abstr. 2167 (1944)]. The nature of the thermal expansion anomaly in high polymers, known as the second-order transition, is examined in some detail. It is suggested that below the transition temperature, T_m, polymer chains can expand sideways but not parallel to their length. At T_m lengthwise expansion becomes prominent, thus accounting for the sudden increase in thermal expansion. Experimental results are presented showing the anisotropic expansion of oriented polymers below T_m. The transition effect is then treated as a problem in viscous flow, which gives rise to various semi-empirical plots connecting T_m with applied forces, plasticizer content, and time effects. The brittle point, T_b, involves highly elastic deformation, and is shown to be a fundamentally different test, although T_m and T_b are sometimes numerically equal. Various factors influencing the brittle point are reviewed briefly.

536.413.2 481

Demonstrating linear therma lexpansion by using the catenary. HITCHCOCK, R. C., AND ZEMANSKY, M. W. *Amer. J. Phys.*, **13**, 329–33 (*Oct.*, 1945).

536.423.15 : 532.713 482

A thermodynamic study of bivalent metal halides in aqueous solution. XIII. Properties of calcium chloride solutions up to high concentrations at 25°. STOKES, R. H. *Trans. Faraday Soc.*, **41**, 637–41 (*Oct.*, 1945).—[See Abstr. 880, 597 (1945)]. Isopiestic v.p. measurements on $CaCl_2$ solutions at 25° have provided values of the water activity, osmotic coefficient, and activity coefficient, extending from 0·1M into supersaturated solutions (10M). These have been combined with e.m.f. data on dilute solutions to provide a subsidiary standard for 1 : 2 salts at 25°, for which γ is known from 0·002M to 10M.

536.423.15 : 532.713 483

A thermodynamic study of bivalent metal halides in aqueous solution. XIV. Concentrated solutions of magnesium chloride at 25°. STOKES, R. H. *Trans. Faraday Soc.*, **41**, 642–5 (*Oct.*, 1945).—Isopiestic v.p. measurements on $MgCl_2$ solutions at 25° have given values of the water activity, osmotic coefficient, and activity coefficient up to saturation. The solubility and the vapour pressure of the saturated solution at 25° have also been determined. The equation of Robinson and Sinclair [Abstr. 4449 (1934)] has been shown to give a fairly reliable extrapolation for $\gamma_{0 \cdot 1}$ when the isopiestic ratios of 1 : 2 salts are plotted in the form m_{CaCl_2}/m_{MX_2}, and the γ values for $MgCl_2$, reported in an earlier paper [Abstr. 1874 (1941)], have been recalculated on a sounder basis by this equation.

536.44 484

Extrapolation of the experimental critical temperatures of the normal paraffins. CORNER, J. *Trans. Faraday Soc.*, **41**, 617–21 (*Oct.*, 1945).—The observed critical temperatures of the normal paraffins from propane to *n*-octane can be represented by any of 4 formulae, each with three arbitrary parameters, with deviations of order 0·1°K. One of them is

$$\log_{10} T_c(^\circ\mathrm{K}) = 2 \cdot 47519 + 0 \cdot 3340 \log_{10} (n - 1 \cdot 1)$$

where n is the number of C atoms. Critical temperatures of the higher paraffins can be estimated with an uncertainty which is small at first and increases rapidly later, being of order 5 % for $C_{25}H_{52}$.

536.521 = 4 485

Optical measurement of the temperatures of incandescent gases. RIBAUD, G., AND LAURE, Y. *Rev. Opt. (Théor. Instrum.)*, **19**, 123–34, 220–1 (1940).—A survey article which deals with the underlying theory and some of the methods which can be used. The precautions necessary are discussed and various modifications are suggested. The conditions under

which the measurements may be regarded as valid are discussed. A. H.

536.7 486
Thermodynamic properties of methane at low temperature. CORCORAN, W. H., BOWLES, R. R., SAGE, B. H., AND LACEY, W. N. *Industr. Engng Chem.*, **37**, 825–8 (*Sept.*, 1945).—The thermodynamic properties from 70° to −230°F and from atm. pressure to 1 400 lbs/in² absolute are derived from existing data and given in tabular and graphical form.

536.7 : 621.43.016.7 487
Thermodynamics of producer gas combustion. Application to internal combustion engines. OLESON, A. P., AND WIEBE, R. *Industr. Engng Chem.*, **37**, 653–60 (*July*, 1945).—[Abstr. 429 B (1946)].

536.71 : 533.21 *see Abstr.* 404

536.753 : 532.713 : 541.123.4 *see Abstr.* 583, 584

536.76 : 533.21 488
Minimum work in multistage compression. ELROD, H. G., JR. *Industr. Engng Chem.*, **37**, 789–90 (*Aug.*, 1945).

536.782 : 532.525 *see Abstr.* 395

ELECTRICITY . MAGNETISM . X-RAYS CHARGED PARTICLES 537/538

537.133 : 537.591 489
A search for the double proton. BHATTACHARYA, P. C. *Proc. Nat. Inst. Sci. India*, 7 (*No.* 3) 275–88 (1941).—Energy loss per cm of air at N.T.P. by mesons, protons, double protons, deuterons and α-particles and their ranges in air and lead have been calculated and plotted against $\log_{10}(Hρ)$. With the help of these curves, a search has been made to find the double proton particle with charge $+2e$ and mass 2% higher than that of an ordinary proton predicted by Bhabha [see Abstr. 2243 (1940)] amongst the published photographs of cosmic ray heavy particles. The result so far obtained is negative. A full discussion of the various ways of continuing the search for the particle is given.

537.2 : 538.1 = 4 490
Synthesis of electrostatics and magnetostatics: The "Ampere" theory applied to electrostatics. BOUTHILLON, L. *Bull. Soc. Franç. Élect.*, **5**, 223–44 (*Aug.*, 1945).—By the use of the tensor character of the field variables and their analysis into "laminar" and "solenoidal," the author exhibits in tabular form the analogy between the formulae of electrostatic and magnetostatic fields. This leads him to formulate the theory of electrostatics in the manner of Ampere's theory of magnetism. G. C. McV.

537.212 491
A generalization of the dielectric ellipsoid problem. JONES, R. C. *Phys. Rev.*, **68**, 93–6 (*Aug.* 1 *and* 15), *Erratum*, 213 (*Nov.* 1 *and* 15, 1945).—In the present generalization, both the ellipsoid and the medium in which it is placed, although homogeneous, are anisotropic and possess conductivities which are anisotropic. The principal axes of the ellipsoid, of the two dielectric tensors, and of the two conductivity tensors, may all be differently oriented. The external field, although uniform in space, varies sinusoidally with time. The latter condition is consistent with the electromagnetic field equations only in a region whose maximum dimension is small compared with $λ/2π$ where $λ$ is the wavelength which corresponds to the frequency in question. Thus the solution given is restricted by the condition that the max. dimension of the ellipsoid must be small compared with $λ/2π$.

537.221 : 621.928 492
A new method of sorting steels and other alloys by employing the tribo-electric properties of metals. DOSCHEK, A. *Instruments*, **18**, 680–1, 710 *and* 712 (*Oct.*, 1945).—[Abstr. 454 B (1946)].

537.223 : 621.319.339 : 539.17 *see Abstr.* 555

537.226 : 621.315.611.029.6 493
Dielectric properties of solids at very high frequencies. FRÖHLICH, H. *Rep. Brit. Elect. Allied Industr. Res. Ass., Ref. L/T157*, 6 *pp.* (1945).—[Abstr. 286 B (1946)].

537.226 : 621.315.616.96 494
The dielectric properties of hydrocarbon resins. RUSHTON, E. *Rep. Brit. Elect. Allied Industr. Res. Ass., Ref. L/T122*, 11 *pp.* (1941).—[Abst. 291 B (1946)].

537.226.2 495
High permittivity crystalline aggregates. JACKSON, W., AND REDDISH, W. *Nature, Lond.*, **156**, 717 (*Dec.* 15, 1945).—[See Abstr. 3009 (1945)].

537.226.2 : 621.3.011.5 : 621.315.612.4 496
Important new dielectrics. SMITH, G. S. *Chem. Age, Lond.*, **53**, 429–31 (*Nov.* 10, 1945).—[Abstr. 287 B (1946)].

537.228.1 : 548.0 : 621.396.611.21 497
Piezo-electric quartz crystals. CREIGHTON, J. L. *P.O. Elect. Engrs' J.*, **38**, 65–9 (*Oct.*, 1945).—[Abstr. 408 B (1946)].

537.228.1 = 3 498
Dynamic measurements on KH_2PO_4 and $NH_4H_2PO_4$ crystals. BANTLE, W., MATTHIAS, B., AND SCHERRER, P. *Helv. Phys. Acta*, **18** (*No.* 5) 389–404 (1945).—Measurements were made of the piezomodulus and other characteristic constants of crystals of KH_2PO_4 and $NH_4H_2PO_4$ in the temperature range −70° to +30°C. The method used has the advantage of being applicable to relatively small crystal plates. The piezomodulus was deduced from a measurement of the permittivity and 2 frequency measurements. The results are presented graphically. The permittivity values compare well with the earlier measurements of Busch. Above +30°C KH_2PO_4 becomes so conductive that accurate determinations of the permittivity are impossible. The behaviour with temperature of the resonance and antiresonance frequencies of KH_2PO_4 is analogous to that of Rochelle salt. Above the upper Curie point the resonance frequency passes through a maximum value and at the Curie temperature there is a sharp minimum. $NH_4H_2PO_4$ behaves in a similar manner. With both crystals the temperature coefficient

of the resonance frequency has a null value, but only at a temperature well below 0°C. A. W.

537.228.5 : 535.338.334 *see Abstr.* 446

537.291 : 621.385.2 499

Electron trajectories in a plane diode—a general result. BRILLOUIN, L. *Elect. Commun.*, **22** (*No.* 3) 212–16 (1945).—A simple mathematical proof is given of this result: In a plane diode with hot cathode and space charge, operated under a voltage whose variation with time is arbitrary, electron trajectories never cross each other provided the current never becomes negative. But if the current is negative during a certain interval of time it is possible that electrons falling back on the cathode may cross electrons emitted from the cathode. These results also apply to a cylindrical diode, except when a magnetic field is present, in which case the behaviour is very different. The case where electrons are emitted with a finite velocity is discussed briefly. For some connected results see Abstr. 1260 B (1945). L. S. G.

537.311.31 500

Electrical resistance of liquid metals. KRISHNAN, K. S., AND BHATIA, A. B. *Nature, Lond.*, **156**, 503–4 (*Oct.* 27, 1945).—The electrical resistance, ρ, which arises from the scattering of the electron waves passing through the metal, is expressed in terms of the attenuation coefficient, which is the fraction of the waves scattered in all directions in a unit volume. This coefficient is calculated, in the case of some typical liquid metals, by a method using the known distribution of intensity in the X-ray diffraction pattern of the liquid and the known X-ray atomic structure factors. Then ρ is calculated. The exceptional electric behaviour of Hg is discussed. L. S. G.

537.311.31 : 539.231 501

Resistivity of thin metallic films. VAN ITTERBEEK, A., AND DE GREVE, L. *Nature, Lond.*, **156**, 634–5 (*Nov.* 24, 1945).—Measurements on Ni films (20 mμ–700 mμ) between − 236°C and 400°C. The temp. coeff. is constant from −183°C to 0°C and above 385°C. In the intervening region its variation is hard to interpret. For films <40 mμ thickness, the temp. coeff. is negative.

537.311.31 : 539.231 = 4 502

Electrical properties of thin layers of nickel. COLOMBANI, A. *C.R. Acad. Sci., Paris*, **215**, 17–18 (*July* 6, 1942).—The resistance characteristics of thin layers of Ni produced by cathodic sputtering in hydrogen, in such a manner as to avoid heating were examined. Experiments were conducted over the thickness range 20 mμ to 178 mμ. Effects of an h.f. electromagnetic field and of ultra-violet irradiation are noted.

537.311.33 503

The electrical conductivity of stannous sulphide. ANDERSON, J. S., AND MORTON, M. C. *Proc. Roy. Soc.A*, **184**, 83–101 (*July* 23, 1945).—The conductivity K was measured between room temperature and 400°C, the law of variation being $K = A_1e^{-E_1/kt} + A_2e^{-E_2/kt}$. Treatment of the sulphide with H_2 at temperatures below those at which reduction to Sn can occur brings about a considerable decrease in conductivity; exposure to O_2 or to H_2S restores the conductivity. The low temperature conductivity is attributable to a stoichiometric excess of non-metal in the lattice, the current being transported by a corresponding number of positive holes, which are located in the surface layers of atoms of the crystallites. The high-temperature conductivity is attributed to the intrinsic conduction of the lattice, and indicates the existence of a conduction band about 1·2 eV above the full band. L. S. G.

537.312.62 : 538.2 = 3 504

Remarks on the work by T. Neugebauer: The absolute diamagnetism of supraconductors. KOCH, K. M. *Z. Phys.*, **121** (*Nos.* 5–8) 488–94 (1943).—Replies to the objections raised by Neugebauer [Abstr. 2187 (1944)] to the author's explanation of the process in a supraconducting hollow sphere. H. G. S.

537.361 505

The effect of thorium chloride on the potential at the interface between vitreous silica and solutions of potassium chloride. WOOD, L. A. *J. Chem. Phys.*, **13**, 429–39 (*Oct.*, 1945).—The effect of the presence of 10^{-6}M $ThCl_4$ on the ζ-potential at the interface between vitreous SiO_2 and 3 solutions of KCl was determined by the streaming potential method. This trace of Th changed the ζ-potential, which was strongly negative with the same solutions without added Th, to positive values of smaller magnitude. The theory of Langmuir by which can be calculated the thickness of the wetting film owing to the ζ-potential was extended to apply to these 4–1, 1–1 electrolyte mixtures, and the effect of this wetting film on the capillary rise of these same solutions was studied. With only one solution (10^{-5}M KCl) containing added Th was the ζ-potential low enough so that the wetting film was negligible in the capillarimeter of Jones and Ray.

537.363 : 679.5 : 621.357.7 506

Electro-deposition of vinyl plastics. FEINLEIB, M. *Trans. Electrochem. Soc.*, **88** (*Prepr.* 6) 12 *pp.* (1945).—[Abstr. 382 B (1946)].

537.52 : 533.15 = 3 *see Abstr.* 402, 403

537.52 : 539.155.2 = 3 *see Abstr.* 543

537.523.4 : 551.594.221 *see Abstr.* 627

537.525 = 3 507

Broadening mechanism of the discharge in a counter tube in the presence of alcohol vapour. HUBER, P., AND ALDER, F. *Helv. Phys. Acta*, **18** (*No.* 4) 232–4 (1945).—The absorption of photons by alcohol vapour in a counter-tube was investigated. Two independent counter-tubes were arranged in coincidence. When the tubes contained 75% air and 25% A, the photons were not absorbed to any considerable extent by the gas mixture. The number of coincidences when the tubes contained varying amounts of alcohol vapour was determined, and the broadening probability, a = (number of coincidences)/(number of impulses in tube A + number in tube B) was calculated. For a pressure of alcohol vapour of 2 cm of

Hg, the absorption of photons is complete within a few mm from the wire. [See Abstr. 1343 (1942)].

A. J. M.

537.525.6 = 3 508

The decay of carrier density and electron temperature in expiring low-pressure discharges. MIERDEL, G. *Z. Phys.*, **121** (*Nos.* 9–10) 574–85 (1943).—The carrier density and the electron temperature are measured in an expiring Hg plasma on short-circuiting a low-pressure discharge in a cylindrical discharge tube. The methods are detailed. For low gas densities quantitative agreement with the deductions from the diffusion theory of the column is found. For higher gas pressures a volume recombination effect appears to act as well. The electron temperature sinks rapidly to <2 000°K and thereafter more slowly.

H. G. S.

537.525.92 : 621.385.1 509

Space charge between coaxial cylinders. PAGE, L., AND ADAMS, N. I., JR. *Phys. Rev.*, **68**, 126–9 (*Sept. 1 and 15*, 1945).—New solutions of the space charge equation are obtained, which converge much more rapidly than Langmuir's solution in the important case where the radius of the outer electrode is large compared with that of the inner electrode.

537.531 : 535.43 : 539.37 510

Disorder scattering of X-rays by local distortions. EKSTEIN, H. *Phys. Rev.*, **68**, 120–4 (*Sept. 1 and 15*, 1945).—The disorder scattering (background) owing to local distortions is caused mainly by the elastic strain field surrounding the distorted zone rather than by the misfit atoms in the zone of distortion. As an example, the scattering caused by a distortion of spherical symmetry is calculated. The result is extended for more general types of distortions. The background increases strongly in the neighbourhood of a line, and it tends towards a constant value for small scattering angles. This explains previous observations on rolled Cu. [See Abstr. 2123 (1939)].

537.531.8 : 615.849 *see Abstr.* 636

537.531.9 : 615.84 : 576.355 *see Abstr.* 628

537.533.72 : 541.128 *see Abstr.* 587

537.533.74 511

The single scattering of electrons in gases. RANDELS, R. B., CHAO, K. T., AND CRANE, H. R. *Phys. Rev.*, **68**, 64–73 (*Aug. 1 and 15*, 1945).—The single scattering of electrons was measured by means of a cloud chamber. Electrons having energies from 0·9 to 12 eMV were used in air, A, Kr and Xe. A total of 2 173 m of track yielded 801 deflections between 15° and 90°. The projected angles of scattering were compared with the theoretical values obtained by making a plane projection of the Mott scattering distribution. The errors inherent in the cloud-chamber method and the corrections to be applied were treated in detail. Combining data for all the energies and gases, the ratio of the experimental to the theoretical scattering was found to be 1·02. The angle intervals 25°–35°, 35°–45° and 45°–55°, taken individually, show a somewhat greater ratio: 1·20, 1·43 and 1·25, respectively. The variations of the scattering cross-section with changes in atomic number, energy, and angle were as expected within the experimental accuracy, and no support was found for the large discrepancies reported by other authors.

537.534 = 4 512

Intensity, energy and nature of ions produced by a new acceleration discharge tube. MORAND, M. *C.R. Acad. Sci., Paris*, **219**, 413–15 (*Oct.* 30, 1944). *Rev. Gén. Élect.*, **54**, 287–8 (*Sept.*, 1945).—The high-voltage discharge in H_2 or D_2 is used as a new source of ions. The aperture through which the ions pass is large, and there is a series of electrostatic lenses to focus the beam of ions and to give them sufficient energy to ensure that they remain as atomic ions in the molecules of residual gas in a region where the pressure is fairly high. They are then accelerated and focused on a target. The intensity of the beam was determined by two methods, one involving deflection in a strong magnetic field, the other using an opposing electric field. Both methods give concordant results and indicate that 0·5 mA can be maintained. The energy of the ions was determined and it was shown that they were atomic.

A. J. M.

537.54 : 621.314.6 513

Rectification in discharge tubes. CHAUDHARI, K. R. *Indian J. Phys.*, **18**, 259–63 (*Oct.*, 1944).—[Abstr. 275 B (1946)].

537.542 514

A copper evaporation method of Geiger-Müller tube construction. DE VOS, P. J. G., AND DU TOIT, S. J. *Rev. Sci. Instrum.*, **16**, 270–2 (*Oct.*, 1945).—With the construction of large BF_3-tubes for use in cosmic-ray neutron research, the conventional tube construction making use of a brass cylinder enclosed with co-axial wire in a glass envelope becomes cumbersome owing to the large weight of the cylinder. A new method of construction is described, making use of the evaporation of Cu in vacuum from the central wire. Some of the characteristics of the new tubes are given together with an estimate of the time of discharge. (0·3 msecs).

537.565 = 4 515

Application of X-ray impulses to the measurement of electron mobility in gases. HERRENG, P. *C.R. Acad. Sci., Paris*, **215**, 79–81 (*July* 20, 1942).—The direct method described for determining the mobility of electrons in gases is free from the disadvantage of uncertain corrections for the variation of mobility with intensity of the electric field, which is associated with the Loeb method, where the electrons are subjected to the action of an alternating electric field.

537.58 : 621.385.032.216 = 4 516

Incandescent cathodes in thermionic valves. New experiments on the thorium oxide cathode. WEINREICH, O. *Rev. Gén. Élect.*, **54**, 243–56 (*Aug.*, 1945).—The various types of incandescent cathode used in valves are considered. Methods of preparing a thorium oxide cathode are reviewed, and a new method using cataphoresis is described. This gives a much more uniform deposit than other methods. The constants A and b of Richardson's equation were determined for two states of activation, and the

optical emissive power and electrical conductivity of Th oxide have been determined. Flashing at about 2 700°K increases the optical emissive power if the Th oxide is in a thin layer on a core of W, but this increase is not permanent, and after about an hour reaches a smaller, steady value. The emissive power of the oxide is not greatly affected by the presence of Zr. The advantages and disadvantages of W, Th oxide and Ba-Sr-Ca cathodes are given. A Ba-Sr-Ca cathode has a greater sp. emission (about 100 mA/W) than the others, but for all-round usefulness the Th oxide cathode has undoubted advantages. A. J. M.

537.591 517

Fine structure in the directional intensity of cosmic rays at Calcutta ($\lambda = 12°$ N, $h = 80$ ft). BHATTACHARYA, P. C. *Proc. Nat. Inst. Sci. India*, **8** (*No.* 2) 273-6 (1942).—The intensity of cosmic radiation in the western azimuth has been measured with a triple coincidence counter telescope of small aperture at various zenith angles from the vertical out to 45° at intervals of 5°. The results show prominences at 10° and 35°, with a slight indication of one at 25°.

537.591 518

Researches on the magnetic deflection of the hard component of cosmic rays. BERNARDINI, G., CONVERSI, M., PANCINI, E., SCROCCO, E., AND WICK, G. C. *Phys. Rev.*, **68**, 109-20 (*Sept.* 1 *and* 15, 1945).—The energy spectrum and positive excess of the hard component of cosmic rays have been investigated both in Rome (50 m above sea level) and at Pian Rosà (3 500 m above sea level) by means of a counter system with deflecting magnetized cores. The results of several measurements are discussed, and the following interpretation is suggested: (1) A positive excess of the order of 20% is found in the hard component, in agreement with the results of other investigators. (2) The hypothesis of the existence of several types of mesons is not confirmed in the lower atmosphere (between 0 and 5 000 m). (3) Assuming for the ratio $\tau/\mu c^2$ of the meson proper lifetime τ to the rest energy μc^2 the value $\tau/\mu c^2 = 3 \times 10^{-8}$ sec/eMV, one has to assume that the energy spectrum of mesons at the top of the atmosphere does not follow a power law $E^{-2\cdot9}$ for low values of the energy ($E < 4 \times 10^9$ eV).

537.591 : 537.133 *see Abstr.* 489

537.591.1 519

The intensity of cosmic-ray electrons relative to mesotrons at sea level. LOMBARDO, B., JR., AND HAYEN, W. E. *Phys. Rev.*, **68**, 74-7 (*Aug.* 1 *and* 15, 1945).—Counter measurements in other laboratories have indicated fewer electrons than one expects on the usual assumptions concerning the properties of mesotrons. A suggested explanation has been decay into two neutrinos and one electron. Measurements were made by direct observation of absorption in Pb plates in a cloud chamber. For the lower energies, where the absorber was primarily glass and radiation losses were relatively small, the results should be quite accurate. For the higher energies the results depend on radiation theory and there is a consequent decrease in reliability. Even for the cases of energies >100 eMV, where the energy is estimated from the nature of the cascade shower, the results are more reliable than counter results since the detailed history of the shower is observed. The number of electrons with energy >6·6 eMV was 38 per 100 mesotrons with $H\rho > 4{\cdot}2 \times 10^5$, the momentum necessary for penetration of all the absorbers. The predicted value is 35, which is within the estimated uncertainty. The shape of the energy distribution and the other absolute values agree reasonably well with theory. Since the assumed decay products are one neutrino and one electron, this experiment favours the usual picture of mesotron decay.

537.591.15 520

Some new investigations on cosmic ray showers. AUGER, P. *Proc. Roy. Soc. A*, **184**, 2 (*July* 23, 1945).—Some experiments are briefly described which are difficult to reconcile with the pure cascade theory, e.g. the presence of penetrating particles (mesons) in extensive atmospheric showers (*A*-showers), the variation with altitude of the frequency of these *A*-showers, and the special structure of some local showers. L. S. G.

537.591.15 521

Cascade showers in lead. NASSAR, S. C. *Amer. Phys. Soc.* (*Proc., July*, 1945). *Abstr. in Phys. Rev.*, **68**, 104 (*Aug.* 1 *and* 15, 1945).—[See Abstr. 626, 627 (1945) and 1976 (1943)].

537.591.5 522

East-west asymmetry of cosmic rays at Calcutta and Darjeeling. BHATTACHARYA, P. C. *Proc. Nat. Inst. Sci. India*, **8** (*No.* 2) 263-72 (1942).—The east-west asymmetry of cosmic radiation at Darjeeling ($\lambda = 16° 30'$ N., $h = 7\,200$ ft) and Calcutta ($\lambda = 12°$ N., $h = 80$ ft) at zenith angles of 15°, 30°, 45° and 60° was measured with a triple coincidence counter telescope. The results agree with those of the previous workers at other stations. The asymmetry increased slightly with 10 cm Pb between the counters at both the places.

538.1 : 535.13 = 4 *see Abstr.* 428

538.1 : 537.2 = 4 *see Abstr.* 490

538.114 523

Survey of the theory of ferromagnetism. VAN VLECK, J. H. *Rev. Mod. Phys.*, **17**, 27-47 (*Jan.*, 1945).—A review. The Weiss theory of the molecular field and its successes are outlined, after which the applications of quantum mechanics to the problem of ferromagnetism are considered. The calculation of susceptibility with the Heisenberg model is dealt with. A recent application of the Bethe-Peierls theory, developed by Peter Weiss, to the calculation of susceptibility gives a linear relationship between (1/susceptibility) and temp., as required by experiment, but the theory has not been extended below the Curie point. The Bloch spin wave theory can be applied at low temperatures. The Heitler-London model is insufficient since it supposes that electrons responsible for ferromagnetism always remain on the same atom. The calculations of Stoner are considered, and the merits of this theory are compared with those of the Heisenberg theory. There is, in many respects, a

parallelism between the quantum theory of ferromagnetism and that of valency. A. J. M.

538.114 : 539.2 524

Virtues and weaknesses of the domain concept. BROWN, W. F., JR. *Rev. Mod. Phys.*, **17**, 15–19 (*Jan.*, 1945).—The experimental basis of the domain theory of magnetism is reviewed.. The usefulness of the theory is limited by its lack of precision, which is due to the lack of a precise theoretical basis for it.

538.114 : 621.318.2 = 4 525

Ferromagnetism and permanent magnets. I. Ferromagnetism. II. Permanent magnets. MICHEL, A. *Rev. Gén. Élect.*, **54**, 115–22 (*April*), *and* 148–59 (*May*, 1945).—Starting with an elementary exposition of the electronic theory of magnetism, ferromagnetism is discussed in the light of modern theories of atomic physics, the behaviour of the Weiss domains under the action of an external field and the modifications of the hysteresis curve by tensile stressing, uniform and non-uniform. The characteristic features of permanent magnets of binary alloys, (*a*) tempered, (*b*) hardened by precipitation, are examined, and a number of tertiary alloys such as Fe–Ni–Al, Fe–Co–W, Fe–Co–Mo. Their properties are compared and summarized in a table. Heat treatment of permanent magnets in a strong magnetic field is discussed. Mention is made of magnets of ferromagnetic oxide powders; the hysteresis curve of one of Fe and Co oxides fritted at 1 000°c is given, of which B_r = 3 000 gauss and H_c = 600 oersteds. H. G. S.

538.12 = 4 526

Directed orientation of the magnetic field. BRYLINSKI, E. *Rev. Gén. Élect.*, **50**, 331–8 (*Nov.*, 1941).—It is maintained that the magnetic field is a directed vector. The tensorial classification is somewhat uncertain. The idea of the magnetic field as having direction but not a sense arose from an extension of P. Curie's geometry of symmetries to material things. This cannot be done because in actual matter there are no symmetries. It is recommended that the theory of magnetism should be reconstructed from the conception of magnetic phenomena as being due to the movement of electric charges. A. J. M.

538.2 : 537.312.62 = 3 *see Abstr.* 504

538.21 : 541.183 = 4 527

Additive law of magnetic properties in mixtures involving adsorption phenomena. BERTHIER, P. *C.R. Acad. Sci., Paris*, **215**, 62–4 (*July* 15, 1942).—Experiments with ferric hydrate sol and ferric chloride solution, in the presence of an adsorbing body of bentonite, indicate that the additive law of magnetic properties, as verified by Pascal and Cotton-Feytis on a large number of mineral compounds, does not only apply to mixtures involving adsorption phenomena. It appears as if adsorption to the bentonite produces an increase in permeability of the absorbed substance. E. R. A.

538.213 : 539.217.1 = 4 528

Magnetic properties of porous bodies. COURTY, C. *C.R. Acad. Sci., Paris*, **215**, 18–20 (*July* 6, 1942).—For the purpose of examining the nature of the permeability variation of a porous solid in passing gradually from a dry atmosphere to an increasingly humid one, experiments were conducted on samples of porcelain and of activated and non-activated carbon. Results and conclusions are presented. E. R. A.

538.214 : 539.153 = 3 529

An approximation method for calculating magnetic susceptibility. KOPPE, H. *Z. Phys.*, **121** (*Nos.* 9–10) 614–28 (1943).—The susceptibility is calculated on the basis of the eigenfunctions of H in the magnetic field. Tables are given of calculated and experimental values of the energy of the ground state and of the susceptibility for He^-, He, Li and Be^{++}. H. G. S.

538.22 530

Ferromagnetic impurities in metals. CONSTANT, F. W. *Rev. Mod. Phys.*, **17**, 81–6 (*Jan.*, 1945).—The effect of ferromagnetic impurities in metals is considered from the point of view of varying the composition, mechanical treatment, and heat treatment. The possible methods in which an impurity could exist in a metal, and the magnetic effect in each case, are considered. There is a close connection between mechanical and magnetic properties. Cold-working may alter the magnetic properties of such a mixture as Cu-Fe by causing a change in the parent metal, inducing precipitation of a ferromagnetic impurity, increasing fluctuations of density of the impurity, or inducing a phase change or other alteration in an impurity already present in the form of inclusions. The possible ways in which the temperature at which heat treatment is carried out, the length of time of treatment, the method of cooling, and the atmosphere may affect the magnetic properties of impure metals are considered. The discussion is illustrated by results obtained with Cu, brass, Ag, and Al. In the case of Cu containing a small amount of Fe, the effect of heat treatment varies greatly with the atmosphere. This is explained by supposing that some of the Fe is dissolved as Fe_3O_4, and reduction and phase changes occur. Similar results are obtained with brass. With Ag, heating up to the melting point failed to eliminate the ferromagnetism of the specimen. This is to be expected since Fe and Ag are immiscible. Fe in Al is present as non-magnetic Al_3Fe. When acted upon by HCl the dissolved Fe plated back on the Al and formed a strongly ferromagnetic film. A. J. M.

538.22 : 548.0 531

Magnetic anisotropy of iodine crystal. RAO, S. R., AND VENKATARAMIAH, H. S. *Curr. Sci.*, **14**, 195–6 (*Aug.*, 1945).

538.22 : 669.15.782 : 621.317.49 532

A magnetic study of phase-change processes—iron-silicon. I. SUCKSMITH, W., HOSELITZ, K., AND HEITLER, H. **II.** HEITLER, H., AND GUGGENHEIMER, K. *Rep. Brit. Elect. Allied Industr. Res. Ass., Ref. N/T*31, 16 *pp.* (1945).—[Abstr. 335 B (1946)].

538.22 : 669.215 533

Magnetization of gold-iron and gold-nickel solid solutions. KAUFMANN, A. R., PAN, S. T., AND CLARK, J. R. *Rev. Mod. Phys.*, **17**, 87–92 (*Jan.*, 1945).—

Fe and Ni behave differently from the magnetic point of view when dissolved in either Cu or Au. In dilute alloys the Fe atoms have a large magnetic moment and the susceptibility varies rapidly with temperature. On the other hand, Ni atoms in dilute alloys appear to lose their magnetic moment and the susceptibility varies in a more complex manner with temperature. Fe-Au alloys are ferromagnetic when as little as 8 at.% Fe is present, but Ni-Au or Ni-Cu alloys do not become ferromagnetic for concentrations of Fe less than 40 at.%. Cu and Au are equivalent when alloyed with Fe or Ni, but the ferromagnetic elements produce a greater effect in Cu than in Au. A. J. M.

538.23 = 4 534

Mathematical representation of the hysteresis cycle. BRICOUT, P. *Rev. Gén. Élect.*, **54**, 183–91 (*June*, 1945).—A general method is given for obtaining an analytic relation between the mean magnetic field, H, and the mean induction, B. This involves tracing a curve, the indicatrix, obtained by plotting log (dH/dB) against B, and fitting a formula to this curve. Three cases are considered: (1) a hyperbolic indicatrix leading to $H = a + b \sinh cB$, where a, b and c are constants; (2) case (1) with a terminal correction leading to $H = a + b \sinh cB + d \exp\{f(B - B_m)\}$ where d and f are constants and B_m is the maximum value of B; (3) a parabolic indicatrix. Various errors arising in the representation are discussed and some numerical and graphical examples are given. L. S. G.

538.23 : 534.37 : 538.65 = 3 *see Abstr.* 538

538.3 : 621.3.01 535

An interesting electrodynamical problem. HOWE, G. W. O. *Wireless Engr*, **22**, 469–73 (*Oct.*, 1945).—Refers to a previous paper [Abstr. 1904 (1945)] in which the application of the Biot–Savart law to the case of 2 electrons gives a paradoxical result. It is shown that this is due to the application of Biot's law being incomplete, and integration round the whole circuit gives the correct result. Another well-known paradox is discussed, that of a circuit with one leg pivoted to enable the area to alter, and proper application of ordinary electrodynamical laws again resolves the paradox.

538.3 : 621.3.01 536

The application of Newton's third law to an electric circuit. HOWE, G. W. O. *Wireless Engr*, **22**, 521–2 (*Nov.*, 1945).—A continuation of the discussion [Abstr. 535 (1946)] upon the supposed violation of Newton's 3rd law by the application of the Biot–Savart formula.

538.615 : 535.331 537

Zeeman effect data for the spectra of lanthanum—La I and La II. HARRISON, G. R., ROSEN, N., AND MCNALLY, J. R., JR. *J. Opt. Soc. Amer.*, **35**, 658–69 (*Oct.*, 1945).—Zeeman effect data are given for 152 lines of La I and 506 lines of La II in the wavelength range 2 257 Å to 7 484 Å. Spectrograms were made at fields of 81 230, 83 370 and 86 570 oersteds using a Bitter electromagnet, and the 24 plates obtained with three diffraction gratings operating simultaneously were measured with an automatic comparator. g values are given for almost all of the classified terms of La I and La II, and the determinations from various lines agree usually to within 0·004 g unit. This makes available an array of unusually precise data for the evaluation of perturbations in typical rich two-electron and three-electron spectra. The g-sum rule of Pauli is verified in a number of cases to within a few tenths of a percent.

538.615 : 535.331 *see Abstr.* 443

538.65 : 538.23 : 534.37 = 3 538

Damping of mechanical vibrations by magnetic hysteresis. KORNETZKI, M. *Z. Phys.*, **121** (*Nos.* 9–10) 560–73 (1943).—A method of evaluating the energy loss is detailed. The equation derived shows that the magneto-mechanical damping increases with the amplitude of the vibration and should be $\propto$ the Rayleigh hysteresis constant and to the cube of the ratio of the magnetostriction to the magnetism at saturation. The calculated damping values agree in their order of magnitude with experimental results. Mechanical working which reduces the Rayleigh hysteresis constant must also diminish the magneto-mechanical damping. H. G. S.

538.653.1 539

Effect of small stresses on magnetic properties. BOZORTH, R. M., AND WILLIAMS, H. J. *Rev. Mod. Phys.*, **17**, 72–80 (*Jan.*, 1945).—The general effect of stress on magnetization is discussed. When a small stress is repeatedly applied and removed from a magnetic material in a uniform field the change in induction, B, is proportional to the stress σ. Domain theory indicates that the cyclic change of induction with stress is dependent on the polarizing induction. $dB/d\sigma$ depends on the saturation magnetostriction, saturation magnetization and the crystal anisotropy constant. This is shown to hold for 45 permalloy and for the Fe-Ni series of alloys. A. J. M.

538.69 : 532.13 = 4 *see Abstr.* 390

538.74 : 527 : 531.383 *see Abstr.* 382

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539.13 : 535.338 *see Abstr.* 444

539.13 : 541.265 *see Abstr.* 601

539.132 540

Force constants of triatomic molecules. GLOCKLER, G., AND TUNG, J.-Y. *J. Chem. Phys.*, **13**, 388–96 (*Oct.*, 1945).—In the general expression of the potential energy of the triatomic molecule XYZ there are 6 force constants c_1, c_1' (valence bond), c_2 (angle deformation), c_3, c_3' (angle bond interaction), and c_4 (bond-bond interaction), of which only 3 can be calculated from the 3 experimentally determined fundamental frequencies. For the isosceles triatomic molecule YX_2 the number of force constants reduces to 4 (c_1, c_2, c_3 and c_4). From a study of all the real values of these 4 force constants, it is seen that they are related to one another by ellipses and straight lines. The graphs of these ellipses indicate the possibility of choosing a certain singular point (near one end of the major axis) giving the relation

$$dc_4/dc_2 = 0 \quad \text{or} \quad dc_4/dc_3 = 0$$

This condition and the equations usually obtained

from the theory of small vibrations permit the calculation of a singular set of 4 force constants of the isosceles/triatomic molecule. When these are applied to isotopic molecules, satisfactory checks between the calculated and experimental frequencies are obtained. The ellipses showing the relation between the force constants show clearly why the simple central force field (c_1, c_2, c_3) or the simple valence force field (c_1, c_2, c_3), containing one interaction constant or crossterm, must yield imaginary values for c_2 and c_3 in certain cases.

539.133 : 541.57 541

A revision of some bond-energy values and the variation of bond-energy with bond-length. SKINNER, H. A. *Trans. Faraday Soc.*, **41**, 645–62 (*Oct.*, 1945).—The bond-energies of the P–P, As–As, S–S, Se–Se and C–C bonds have been reconsidered in the light of recent spectroscopic and thermal data. Tentative alterations in the values of the O–O, N–N, Si–Si and Ge–Ge bond-energies are also proposed. The bond-energies of a number of bonds to hydrogen and the halogens are tabulated. The assumption of a relationship between the energy and length of a bond is examined for C–C, C–O, C–N, N–O and C–Cl bonds. The energy-length curves derived are found to obey, approximately, an equation $Er^n = A$, where E is the bond-energy, r the bond-length, and n and A are specific bond-constants; $n = 2{\cdot}5$–$5{\cdot}0$. It is found that certain bonds which are longer than would normally be expected are correspondingly weaker than normal bonds.

539.152.1 : 539.167.3 = 3 *see Abstr.* 551

539.153 : 535.343 542

Calculation of *f*-values of potassium atom. NANDA, J. N. *Indian J. Phys.*, **19**, 7 (*Feb.*, 1945).—Employing the empirical and the Hartree fields, the *f*-values of the K atom have been determined. A striking feature of the calculation is that the *f*-value of the first line is greater than unity. The sum rule suggests that the contribution towards the *f*-value by the continuous absorption at the head of the series limit must be 0·05, i.e. much larger than the expected value of 0·0002 from the monotonic curve obtained theoretically by Phillips. [See Abstr. 2990 (1932)]. It appears, therefore, that the extrapolation of this curve is not warranted. Ditchburn's recent experiments [Abstr. 2326 (1943)] showing marked increase in atomic absorption of high frequencies seem to support this view.

539.153 : 538.214 = 3 *see Abstr.* 529

539.153.4 : 530.145 = 3 *see Abstr.* 380

539.155.2 : 537.52 = 3 543

On the possible uses of the Kunsman anodes for the mass-spectrographic separation of isotopes. WALCHER, W. *Z. Phys.*, **121** (*Nos.* 9–10) 604–13 (1943).—The possibility of utilizing the Kunsman-Koch anode for producing elements in the form of ions with an ionization work-function smaller than the exit work-function of the carrier (W with adsorbed O_2, max. value 9 eV) is shown to exist only in the In, Ga, Tl group, apart from the alkalis. The alkaline earth metals are unsuitable for ionization by this method. Reasons are given. The shape and production of the anodes are described with examples of their application. The anodes can be regenerated. H. G. S.

539.155.2 : 539.172 = 3 *see Abstr.* 556

539.16.08 544

Questions of measurements and standardization in radioactivity. JOLIOT-CURIE, I. *Proc. Roy. Soc. A*, **184**, 2 (*July* 23, 1945).—What matters in most experiments is the quantity of a radioelement expressed in "number of disintegrations per second," the unit being the "curie." Some remarks are made concerning the measurement of this quantity in various cases. L. S. G.

539.163.2 545

The beta-ray spectra of Cu^{64} at low energies. BACKUS, J. *Phys. Rev.*, **68**, 59–63 (*Aug.* 1 *and* 15, 1945).—An electrostatic β-ray spectrometer was constructed using the focusing action of the electric field between concentric cylindrical conductors. A Geiger tube counter using an argon-alcohol mixture was used; a technique for making windows for the counter was developed whereby electrons of energies as low as 5 ekV could be counted. A source of radioactive Cu^{64} was mounted on a very thin collodion film in order to eliminate the effects of back scattering. The positron and electron spectrum of Cu^{64} was plotted with the apparatus in the region below 50 ekV. It was found that the ratio of the number of positrons to the number of electrons in this region did not agree with the number predicted by the Fermi theory of β-disintegration.

539.165 = 3 546

Wilson cloud-chamber investigation of the emission of light positive particles by β-radioactive bodies. HEINE, H. G. *Helv. Phys. Acta*, **17** (*No.* 4) 273–97 (1944).—Some constructional details of the cloud-chamber are given and an automatic cloud-chamber is described together with the circuit of its control apparatus. Measurements are made of the energy distribution for tracks of positive curvature emanating from sources consisting of U*X*, Th ($B + C + C''$), Ac ($B + C''$) and Ra*E*. The relative frequencies e^+/e^- are approximately 0·004, 0·003 and 0·003 respectively. Measurements made with the magnetic β-spectrograph are also reported. L. S. G.

539.167.3 547

Neutron-induced radioactivity in lutecium and ytterbium. ATTERLING, H., BOHR, E., AND SIGURGEIRSSON, T. *Ark. Mat. Astr. Fys.*, **32 A** (*No.* 2) 12 *pp.* (1945).—Bombardment by slow neutrons gave the following active isotopes, whose decay constants are given. Negative electrons only are emitted.

Lu^{176},	3·67 ± 0·03 h.	$E_{max} = 1{\cdot}25 \pm 0{\cdot}07$ eMV
Lu^{177},	6·6 ± 0·1 d.	$E_{max} = 0{\cdot}47 \pm 0{\cdot}05$ eMV
Yb^{177},	1·9 ± 0·2 h.	$E_{max} = 1{\cdot}15 \pm 0{\cdot}10$ eMV
Yb^{175}	4·2 ± 0·2 d.	$E_{max} = 0{\cdot}45 \pm 0{\cdot}07$ eMV
	~ 45 d.	$E_{max} = \sim 0{\cdot}3$ eMV

The cross sections, referred to Dy (2·60 h) are also given.

539.167.3 548

On neutron-induced radioactivities in Rh. HOLE, N. *Ark. Mat. Astr. Fys.*, 32 A (*No.* 3) 9 *pp.* (1945).—Fast neutron bombardment of Rh^{103} gives by a $(n, 2n)$ process the isotope Rh^{102}, which has a half-life of 200 ± 10 d and which emits positive and negative electrons. The upper limits of the spectra are: For negatrons, 1·04 ± 0·08 eMV; for positrons, 1·13 ± 0·08 eMV. The bombardment by fast neutrons also gives a nucleus Rh^{103}, isomeric with the stable nucleus, which has the half-life 53 ± 3 min and which emits a γ-radiation with the energy 19 ± 3 kV.

539.167.3 = 3 549

Metastable states of the silver nuclei Ag^{107} and Ag^{109}. BRADT, H., GUGELOT, P. C., HUBER, O., MEDICUS, H., PREISWERK, P., AND SCHERRER, P. *Helv. Phys. Acta*, 18 (*No.* 4) 256–8 (1945).—The electron spectrum of a radioactive Cd preparation obtained by chemical separation from silver bombarded with 6·5 eMV protons has been investigated with the β-spectrograph. Groups of lines corresponding to periods of 6·7 hr and 158 days have been found. The difference of energy of the two Ag isomers is 5·1 ± 0·2 ekV. The half-lives of the Ag isomers are 44·3 ± 0·2 and 40·5 ± 0·7 sec, respectively. The following transformations have thus been established:

$$Cd^{107,\,109} \xrightarrow[6{\cdot}7\ \mathrm{h}]{K,\ e^+} Ag_I^* \xrightarrow[44{\cdot}3\ \mathrm{sec}]{93{\cdot}5\ \mathrm{ekV}} Ag^{107,\,109};$$

$$Cd^{107,\,109} \xrightarrow[158\ \mathrm{d}]{K} Ag_{II}^* \xrightarrow[40{\cdot}5\ \mathrm{sec}]{88{\cdot}4\ \mathrm{ekV}} Ag^{107,\,109}$$

A. J. M.

539.167.3 = 3 550

Radioactive transformation of Cr^{51}. BRADT, H., GUGELOT, P. C., HUBER, O., MEDICUS, H., PREISWERK, P., AND SCHERRER, P. *Helv. Phys. Acta*, 18 (*No.* 4) 259–60 (1945).—The existence of Cr^{51} with a half-life of 36·5 days has been confirmed. It has been obtained by bombardment of V with 6·5 eMV protons. Together with the V *K*-radiation, a γ-radiation of (330 ± 1) ekV was observed. Spectrograph experiments show *K*- and *L*-conversion electrons of a (237 ± 1) ekV line, as well as those of the 330 ekV line, although absorption measurements show no sign of a 237 ekV component. Positron emission from Cr^{51} could not be detected. γ-γ-coincidence measurements show no trace of annihilation radiation. A γ-line of 1 eMV observed by Walke *et al.* [Abstr. 1096 (1940)] could not be detected. A. J. M.

539.167.3 : 539.152.1 = 3 551

Test of the Fermi theory of β-disintegration by determination of the probability of taking up a *K*-electron and e^+-emission of 6·7 hr cadmium. BRADT, H., GUGELOT, P. C., HUBER, O., MEDICUS, H., PREISWERK, P., AND SCHERRER, P. *Helv. Phys. Acta*, 18 (*No.* 5) 351–68 (1945).—The radiation from $Cd^{107,\,109}$, of half-life 6·7 hr, has been investigated. 6·7 hr Cd can undergo transformation not only by taking up a *K*-electron but also by emission of a positron. The positron spectrum has been investigated. E^+_{max} is 0·32 ± 0·01 eMV. The threshold energy of the reaction Ag (p, n) $Cd_{6\cdot7\,\mathrm{hr}}$ is 2·19 ± 0·01 eMV. Coincidence measurements show that the positron emission is not coupled with the 0·846 eMV nuclear γ-radiation. According to Fermi's theory the β^+-disintegration is a permitted transformation. The ratio of the probability of taking up a *K*-electron and the emission of a positron is 320 ± 30. This is in good agreement with the value given by Fermi's theory, but the coupling relation of Konopinski and Uhlenbeck gives a value 60 times too large. The absolute intensity of the 0·846 eMV γ-radiation is $4{\cdot}2 \times 10^{-3}$. A term scheme for the disintegration of 6·7 hr Cd is given. A. J. M.

539.167.3 : 612.44 = 4 *see Abstr.* 631

539.17 552

Attempt to single out some fission processes of uranium by using the differences in their energy release. MEITNER, L. *Rev. Mod. Phys.*, 17, 287–91 (*April–July*, 1945).—In order to discover the mechanism of the fission of U, the kinetic energy of the fragments has been investigated. The particles emitted can be collected on foils placed close to the U bombarded with neutrons. If a stack of foils of sufficient thickness is used it is possible to single out different groups of fission products on the different foils. Thin collodion foils were used as collectors. The activity induced in them was weak. Decay curves for each foil were obtained. The experiments indicate that the method, with some refinements, might lead to useful results. A. J. M.

539.17 553

Hρ-distribution of fission fragments. LASSEN, N. O. *Phys. Rev.*, 68, 142–3 (*Sept.* 1 *and* 15, 1945).—The total charge of fission fragments of U has been determined by deflection in a magnetic field, and Hρ-distribution curves have been obtained. The lighter group of fragments has a slightly greater value of Hρ than the heavier one. The total charges of the light and heavy groups are 20*e* and 22*e*, respectively, where *e* is the electronic charge. A. J. M.

539.17 554

The release of atomic energy. OLIPHANT, M. L. *Nature, Lond.*, 157, 5–7 (*Jan.* 5, 1946).

539.17 : 621.319.339 : 537.223 = 3 555

On a million volt installation for the transmutation of atoms. VON ARDENNE, M. *Z. Phys.*, 121 (*Nos.* 3–4) 236–67 (1943).—A detailed description with illustrations and diagrams of a million volt van de Graaf belt-generator for the production of deuterons, protons and electrons. The practical results obtained are appended. H. G. S.

539.172 : 539.155.2 = 3 556

On the strontium and yttrium isotopes resulting from the fission of uranium. HAHN, O., AND STRASSMANN, F. *Z. Phys.*, 121 (*Nos.* 11–12) 729–45 (1943).—The new Yt isotope has a half-value time of 20 min and the Sr isotope of 2 ± 0·5 min. The methods and the results are given in detail. H. G. S.

539.174 557

An attempt to obtain nuclear excitation by means of X-rays. EKLUND, S. *Nature, Lond.*, 156, 690–1 (*Dec.* 8, 1945).—Several metals were irradiated with 400 kV X-rays but no activity was observed, with the possible exception of Ag. The activity reported by

Trumpy (*Bergens Museums Årbok* 1943, *Naturvitenskafelig rekke* 10) is thought to have been a spurious effect. [See Abstr. 1855 (1945), 301 B (1942)].

539.18 558

Life-time of the neutral meson. PAIS, A. *Nature, Lond.*, **156**, 715–16 (*Dec.* 15, 1945).

539.185 = 3 559

Neutron emission of the uranium nucleus as the result of its spontaneous fission. MAURER, W., AND POSE, H. *Z. Phys.*, **121** (*Nos.* 3–4) 285–92 (1943).—The half-value time for U^{238} is found to be $2{\cdot}5 \times 10^{15}$ years for the spontaneous nuclear fission from measurements made with quantities of uranium of about 4 kg. H. G. S.

539.185 = 3 560

Spontaneous neutron emission of uranium and thorium. POSE, H. *Z. Phys.*, **121** (*Nos.* 3–4) 293–7 (1943).—Measurements in a mine to avoid the effect of cosmic radiation give a half-value time of $3{\cdot}1 \times 10^{15}$ years for U^{238} and $1{\cdot}7 \times 10^{17}$ years for Th^{232}. [See Abstr. 559 (1946)]. H. G. S.

539.185.7 = 3 561

Effective cross-sections for the absorption of slow neutrons. VOLZ, H. *Z. Phys.*, **121** (*Nos.* 3–4) 201–35 (1943).—A method is developed utilizing flat absorber plates immersed in water in which thermal neutrons are produced; the density at the surface of the plate is measured by means of a thin indicator for thermal neutrons and compared with the density and the original homogeneous field. From the ratio of these two values the cross-section for absorption of the plate substance is determined. The effective cross-sections of 49 elements measured in this way are tabulated, with previous results for comparison, and confirm on the whole the irregular dependence on the atomic weight. A second table gives the most important results to date of measurements of total scattering and absorption cross-sections. H. G. S.

539.185.7 = 3 562

Determination of the effective cross-section of commercial aluminium for the capture of slow neutrons. GEHLEN, J. *Z. Phys.*, **121** (*Nos.* 3–4) 268–84 (1943).—Two independent methods are used—absorption of slow neutrons by Al in paraffin, comparison of the β-activity of an Al foil with that of Ag. From the first the value is $q_{Al} = (0{\cdot}43 \pm 0{\cdot}07) \times 10^{-24}$ cm^2, and from the second $q_{Al} = (0{\cdot}19 \pm 0{\cdot}02) \times 10^{-24}$ cm^2. The discrepancy is attributed to Cd or other rare earth inclusions, e.g. Ga. A possible explanation is an unknown, long-period excitation of Al by slower neutrons. The half-value times involved are: Ag, short period, $33{\cdot}2 \pm 2$ sec; Ag, long period, $148{\cdot}5 \pm 1{\cdot}5$ sec; Al, 140 ± 2 sec. H. G. S.

STRUCTURE OF SOLIDS 539.2

539.2 : 538.114 *see Abstr.* 524

539.214.07 563

Rubber plastimeter with uniform rate of shear—shearing-cone plastimeter. PIPER, G. H., AND SCOTT, J. R. *J. Sci. Instrum.*, **22**, 206–10 (*Nov.*, 1945).—The instrument is suitable for investigating the plastic-flow relations of highly viscous materials over a wide range of stress. A mushroom-shaped rotor, having upper and lower surfaces conical, is rotated in the plastic material contained in a cylindrical mould. With this type of shearing surface the rate of shear is uniform throughout the material, except for a small edge zone, thus overcoming some disadvantages of previous plastimeters. The mechanical design is based on the Mooney shearing-disc plastimeter [see Abstr. 1831 (1934), 52 (1937)] except that provision is made for a wide range of speeds of rotation.

539.217.1 : 538.213 = 4 *see Abstr.* 528

539.23 : 541.183 : 541.128 *see Abstr.* 588

539.23 : 778.6 564

The deposition of metal films: their application to colour photography. YARWOOD, J. *Photogr. J.B.*, **85**, 97–101 (*Sept.-Oct.*, 1945).—An account of the evaporation and sputtering methods for the deposition of various metal films on glass, collodion and other supports likely to be employed in the beam-splitters of colour cameras. The most suitable metals for the purposes of colour separation work are considered and their properties when deposited as films are discussed.

539.231 : 537.311.31 *see Abstr.* 501, 502

539.233 : 541.183 *see Abstr.* 594

539.234 : 548.5 = 3 *see Abstr.* 607

539.26 : 677.31 565

The chemistry and technology of wool. II. The X-ray interpretation of wool. ASTBURY, W. T. *J.R.Soc. Arts.* **43**, 613–22 (*Oct.* 26, 1945).—A lecture survey of wool, hair, or keratin as a fibrous protein, and covering structure as determined by X-ray patterns, effect of stretching and steam and moisture treatment, and a discussion of the α-fold of the keratin-myosin-fibrinogen group and the close packing of side chains, leading to the explanation of long-range elasticity. Finally it is shown how the lessons learnt from X-ray studies have led to the elucidation of the essential feature of the structure of the crystalline proteins and thence to the principles underlying the production of artificial protein fibres such as "artificial wool." [See Abstr. 604 (1946)]. N. M. B.

ELASTICITY . STRENGTH RHEOLOGY 539.3/.8

539.313 566

Complex potentials in two-dimensional elasticity. I. STEVENSON, A. C. *Proc. Roy. Soc. A*, **184** (*No.* 997) 129–79 (*Aug.* 21, 1945).—Two complex potentials are introduced and in terms of these the displacements and stresses may be simply expressed. The nature of the potentials is discussed and the conditions that the solution for the displacements shall be physically admissible are found. The method results in a very marked economy of effort in the solution of problems compared with the usual method employing Airy's stress function, etc. The power of the method is illustrated by finding the complex potentials for a wide variety of problems. Solutions are considered in various co-ordinate systems, cartesian, polar, elliptic,

bipolar and cyclic. Solutions are given for a concentric ring space and for an unstressed hole in an infinite plate; and nuclei of strain in an infinite or semi-infinite plate or in a circular disc are considered. The main object of the paper is to extend to two-dimensional elasticity the well-known usefulness of the complex variable method in non-viscous hydrodynamical theory. L. S. G.

539.313 567

Complex potentials in two-dimensional elasticity. II. STEVENSON, A. C. *Proc. Roy. Soc. A*, **184** (*No.* 997) 218–29 (*Aug.* 21, 1945).—Using the method introduced in Abstr. 566 (1946) the exact expressions, in finite terms, are found for the complex potentials which solve two problems of generalized plane stress for a circular disc. The first is that of a heavy circular disc fixed in a vertical plane at an eccentric point, and this includes, as a particular case, a problem studied by Mindlin [Abstr. 4777 (1938)]. The second problem concerns the rotation of a circular disc in its own plane at a steady rate about an eccentric point. The potentials, in each case, consist of simple terms expressed in Cartesian co-ordinates. In the second problem a possible discontinuity in the functional forms of the complex potentials is discussed. L. S. G.

539.37 : 535.43 : 537.531 *see Abstr.* 510

539.374 : 539.89 568

Effects of high hydrostatic pressure on the plastic properties of metals. BRIDGMAN, P. W. *Rev. Mod. Phys.*, **17**, 3–14 (*Jan.*, 1945).—Ordinary metals will stand much increased plastic deformation without fracture under hydrostatic pressure up to 30 000 kg/cm². Thus specimens of mild steel may show elongations of hundreds-fold without fracture compared with two- or three-fold elongations under atmospheric pressure. Cracks are prevented from forming by the pressure. It has been shown that the distribution of strain in the neck is practically uniform. The distribution of stress in the neck comprises (1) the applied hydrostatic pressure, (2) a uniform tension across the neck and (3) a hydrostatic tension increasing from zero at the outer surface of the neck to a max. on the axis. The increase of tensile strength under pressure is to be anticipated in view of the closer approach of the atoms, with consequent intensification of atomic forces. The dependence of fracture on past history of the test piece as well as on stress and strain indicates that any precise theory of plasticity under high hydrostatic pressure requires a more detailed knowledge of structure than suffices for the study of ordinary bulk properties within the elastic limit. J. S. G. T.

539.38 569

The problem of Saint Venant for a cylinder with free sides. SYNGE, J. L. *Quart. Appl. Math.*, **2**, 307–17 (*Jan.*, 1945).—The general mathematical statement of the problem and of various relaxed (simplified) problems associated with it is given. The Saint Venant solution is then given in a tensor notation, and the basic eigen-value problem associated with the exponential type of solution is set up. This formulation is linked with the solution for a cylinder of circular section. L. S. G.

539.382 570

Stress systems in aeolotropic plates. III. GREEN, A. E., AND TAYLOR, G. I. *Proc. Roy. Soc. A*, **184** (*No.* 997) 181–95 (*Aug.* 21, 1945).—The fundamental stress functions obtained in the previous papers [Abstr. 34 (1940)] are used to find the stress distribution in an infinite aeolotropic plate which contains a circular hole and is subjected to tension in one direction. The material of the plate is assumed to have two perpendicular directions of symmetry. The stress functions which satisfy the equations of equilibrium produce single-valued expressions for the corresponding stresses and displacements and these are combined in an infinite series so as to satisfy the boundary conditions. Numerical work is carried out, for certain specimens of oak and spruce. An attempt is made to apply the calculated stress concentrations in conjunction with measurements of ultimate strength to determine the kind of failure that might be expected near a hole in a highly stressed wood plate. L. S. G.

539.388.8 : 541.182.5 571

Swelling stresses in gels. BARKAS, W. W. *For. Prod. Res. Spec. Rep. No.* 6 (*D.S.I.R. Publ., Lond.*) 62 *pp.* (1945).—A report on the calculation of the swelling pressures and elastic constants of gel structures from their moisture-absorbing properties is presented as a general theory of swelling stresses in gels. The fundamental equation connecting mechanical stress with the v.p. is derived from first principles, using a simple thermodynamic cycle, but the problem is treated from the standpoint of elasticity. The range covered is: swelling of solutions and rigid gels, swelling pressures and elastic constants, influence of applied stresses on the sorption isothermal, elastic constants of gels, sorption compression and bulk modulus, and the specific volume of water in tension. Sorption hysteresis is also considered because the present theory of swelling pressures offers a new explanation of the existence of this phenomenon in gels and of its absence in true solutions. Finally, the case of wood as a cellular structure is treated in detail and some elastic constants both of the gel material and of the gross wood is calculated from sorption and swelling data only. N. M. B.

539.4 : 679.5 *see Abstr.* 639

539.4.01 : 539.56 *see Abstr.* 579

539.4.016.3 : 620.191.33 : 669.14 572

Theory of stress corrosion cracking of mild steel in nitrate solutions. WABER, J. T., MCDONALD, H. J., AND LONGTIN, B. *Trans. Electrochem. Soc.*, **87** (*Prepr.* 32) 23 *pp.* (1945).—Stress corrosion cracking of mild steel in nitrate solutions is shown to depend upon the stress-accelerated age hardening of the steel. A correlation between the cracking times and the extent of ageing was made. Both the extent of ageing after a standard treatment and the rate of cracking after several heat treatments were correlated with the free N factor. The concept of "free" N unifies much previous data on the supposedly independent effects of C, N, P, O and Al. The correlations imply that a steel can be made only relatively more, but not com-

pletely, resistant to stress corrosion cracking. It was possible to crack repeatedly supposedly resistant mild steels. The path of the cracks is intercrystalline. A satisfactory experimental procedure was evolved from auxiliary experiments which were used to select the test solution and the design of the specimen. Cracking proceeds rapidly when steels are loaded to stresses slightly < the yield point but > a certain threshold stress. The acceleration of quench ageing of mild steel by elastic stresses was shown. The age hardening mechanism of stress corrosion cracking was partially confirmed. The conditions under which cracking occurs do not differ in principle from those necessary to produce caustic embrittlement.

539.42 573

The fracture stress of steel. ZENER, C. *Rev. Mod. Phys.*, **17**, 20–6 (*Jan.*, 1945).—Fracture stress is taken to mean the stress at which the material would fracture if further plastic deformation could be prevented, and a curve is suggested in which fracture stress is plotted against strain. An idea of this curve may be obtained by pulling a series of specimens to different strains at room temp., then immersing them in liquid N_2 and finding the stress necessary for fracture. This method arises from the fact that at liquid N_2 temps. most steels break without much deformation. The fracture stress rises with increase of strain, and when the fracture stress curve is superimposed on the normal stress strain curve, fracture occurs at the point of intersection of the two curves. It is thought that if it were not for the tiny incipient cracks in steel, the material could withstand about 10 times its present loads without fracture. In the case of two types of steel of equal hardness and similar normal stress-strain curves, one with cementite plates in its structure will have a lower fracture stress curve than a steel with cementite spheres, and, consequently, will be brittle at any temp. whereas the latter never will. The increase of fracture stress with rate of strain is also mentioned. A. C. W.

539.42 574

Time factors in the breaking of toughened glass. HAWARD, R. N. *Nature, Lond.*, **157**, 21–2 (*Jan.* 5, 1946).

539.434 575

Creep of metals. DUSHMAN, S., DUNBAR, L. W., AND HUTHSTEINER, H. *J. Appl. Phys.*, **15**, 108–24 (*Feb.*, 1944).—In a plot of elongation versus time at constant temp. and constant total stress there is initially a rapid rate of creep, after which it decreases gradually to a constant value, which is maintained for a certain period beyond which the rate increases rapidly and rupture occurs. In the present paper, only the constant creep rate is considered, and a theory is developed which is given in some detail in Abstr. 576 (1946). The experimental tests were made on wires about 10 cm in length, which, for tests at or below 500°C, were heated in a nichrome tubular furnace, while for higher temps. the test wire was heated electrically and its brightness compared with that of a calibrated ribbon filament lamp. The elongations were measured automatically. The wires tested included constantan, Al, Al-Mg alloy, commercial Al, Pt, Ni-Mo alloy and Ag, and the constants in the equations have been evaluated. A. C. W.

539.434 : 541.127 576

Application of theory of absolute reaction velocities to creep of metals. DUSHMAN, S. *Rev. Mod. Phys.*, **17**, 48–9 (*Jan.*, 1945).—Arrhenius accounted for the influence of temperature on the rate of chemical reactions by introducing the concept of activation energy and gave the equation $v = Ae^{-Q/RT}$, from which Eyring deduced the relation for the absolute velocity of any unimolecular reaction for which the activation energy was ΔQ, viz.:—

$$v = \frac{kT}{h} e^{\Delta\eta/R} e^{-\Delta Q/RT}$$

where h = Planck's const., k = Boltzmann const., η = entropy of activation, and Q = energy of activation. This equation has been applied to viscous flow, and thence to the phenomenon of creep of metals, for which

$$v = v_0 T e^{-Q/RT}(e^{x} - e^{-x})$$

Here $x = jaS/(2RT)$ in which a denotes the vol. in cm^3 per g-atom of the unit of flow, S is the applied tensile stress in $g.cm^{-2}$, and $j = 2{\cdot}39 \times 10^{-8}$ cal. erg^{-1}, while

$$\log v_0 = 10{\cdot}319 + (\Delta\eta/4{\cdot}577)$$

and $$\log (v/T) = \log (v_s/T) + jaS/9{\cdot}154T$$

where $$\log v_s/T = 10{\cdot}319 + \Delta\eta/4{\cdot}577 - Q/4{\cdot}577T$$

Results are given for typical tests on wires. [See Abstr. 575 (1946)]. A. C. W.

539.501 : 541.182.5 : 679.5 577

Gel as a definitive property in GR-S technology. WHITE, L. M., EBERS, E. S., SHRIVER, G. E., AND BRECK, S. *Industr. Engng Chem.*, **37**, 770–5 (*Aug.*, 1945).—The principal objective was to determine the significance of gel fraction in GR-S in relation to its processing and physical properties. Data indicate that the presence of low-swelling (tight) gel materially improves certain important types of processing behaviour, but adversely influences many physical properties of the vulcanizate. A theory is advanced to explain the observed effects of gel, based on the exclusion of filler by the gel, and is supported by limited direct evidence.

539.53 : 620.178.154 578

A method for determining the instantaneous hardness of plastic substances. CAMERON, A. *Trans. Faraday Soc.*, **41**, 583–6 (*Oct.*, 1945).—[Abstr. 228 B (1946)].

539.56 : 539.4.01 579

Mechanism of brittle rupture. MURGATROYD, J. B., AND SYKES, R. F. *Nature, Lond.*, **156**, 716–17 (*Dec.* 15, 1945).—[See Abstr. 174 (1946)].

539.622 : 621.771 580

Computations of rolling load, torque and roll-face pressure in metal strip rolling. COOK, M., AND LARKE, E. C. *J. Inst. Met.*, **71**, 557–80 (*Nov.*, 1945).—[Abstr. 437 B (1946)].

539.89 : 539.374 *see Abstr.* 568

PHYSICAL CHEMISTRY 541

REACTION KINETICS 541.121/.128

541.123.2 581

Phase behaviour of binary carbon dioxide–paraffin systems. POETTMANN, F. H., AND KATZ, D. L. *Industr. Engng Chem.*, 37, 847–53 (*Sept.*, 1945).—The vapour-liquid equilibria and critical loci of the binary CO_2–C_3H_8, CO_2–C_4H_{10} and CO_2–C_5H_{12} systems were determined. The complete transition from the CO_2–C_2H_6 system which forms constant-boiling mixtures to the CO_2–C_5H_{12} system which has normal behaviour is shown. The experimental data are given in both graphical and tabulated form.

541.123.21 582

Liquid-vapour equilibrium in mixtures of 2,3-butylene glycol and water. BLOM, R. H., MUSTAKAS, G. C., EFRON, A., AND REED, D. L. *Industr. Engng Chem.*, 37, 870–2 (*Sept.*, 1945).—Liquid-vapour equilibrium measurements were made for *meso*-2,3-butylene-glycol–water system at pressures and concentrations covering the ranges to be encountered in the recovery of glycol from fermentation liquors. From these data a chart was prepared showing vapour composition as a function of pressure for certain arbitrary liquid concentrations. The chart is sufficiently accurate for design calculations.

541.123.4 : 532.713 : 536.753 583

The energy and entropy of solution of silver chloride in methanol-water mixtures. I. PARTON, H. N., DAVIS, D. J., HURST, F., AND GEMMELL, G. D. *Trans. Faraday Soc.*, 41, 575–9 (*Oct.*, 1945).—The activity product of AgCl has been obtained from e.m.f. measurements in three mixtures, containing 10%, 20% and 50% of methanol by weight, over a range of temperatures from 15°c to 45°c. The solubility in each solvent has been obtained and the thermodynamic quantities have been calculated for the process, $AgCl(s) \rightarrow Ag^+$ (solv.) + Cl^- (solv.).

541.123.4 : 532.713 : 536.753 584

The energy and entropy of solution of silver chloride in methanol-water mixtures. II. PARTON, H. N., AND PERRIN, D. D. *Trans. Faraday Soc.*, 41, 579–82 (*Oct.*, 1945).—The measurements of Abstr. 583 (1946) have been made for a 75% methanol-water mixture, and the solubility derived. Thermodynamic quantities for the solution processes of the solid salt, and of the gaseous ions have been derived and compared with data calculated by some theoretical formulae.

541.123.7 585

Vapour-liquid equilibria in mixtures of volatile paraffins. HANSON, G. H., AND BROWN, G. G. *Industr. Engng Chem.*, 37, 821–5 (*Sept.*, 1945).—Two 5-component mixtures of volatile paraffin hydrocarbons were prepared having critical temperatures of approx. 100°F and critical pressures of about 2 000 lb/in² absolute. Vapour-liquid equilibrium determinations were made on these two mixtures at 100°F and at pressures up to that of the single phase. Equilibrium constants at 100°F from these two mixtures were compared with equilibrium constants from a binary and a ternary mixture, each of which has a critical temperature of 100°F and a critical pressure of approx. 2 000 lb/in² absolute. Within the limits of experimental error it appears that the equilibrium constants of the volatile paraffin hydrocarbons in binary or complex mixtures of paraffins may be defined by specifying the temperature, pressure, and "convergence pressure" corresponding to the temperature of the equilibrium. The convergence pressure is the critical pressure of a mixture at its critical temperature. At any other temperature the convergence pressure is the pressure at which the equilibrium constants appear to converge to unity.

541.124 586

Some notes on the theory of unimolecular gas reactions in transition-state symbolism. EVANS, M. G., AND RUSHBROOKE, G. S. *Trans. Faraday Soc.*, 41, 621–9 (*Oct.*, 1945).

541.127 : 539.434 *see Abstr.* 576

541.127 : 542.952.6 : 541.145 *see Abstr.* 590

541.127.1 : 548.524 *see Abstr.* 608

541.128 : 537.533.72 587

Electron microscopy of catalysts. TURKEVICH, J. *J. Chem. Phys.*, 13, 235–9 (*June*, 1945).—Surveys the appearance in the electron microscope of a number of important catalysts, the results obtained being presented in the form of electron micrographs. The catalysts studied include PtO, Pt on charcoal, various asbestos, Al_2O_3 and SiO_2 catalysts, ZnO, methanol and the Fischer catalyst. The micrographs illustrate the various ways in which large surfaces for catalysis are produced, together with the value of the electron microscope for the evaluation of materials as possible catalysts. A. H.

541.128 : 539.23 : 541.183 588

Catalysis—a challenge to the physicist. BEECK, O. *Rev. Mod. Phys.*, 17, 61–71 (*Jan.*, 1945).—The great technical importance of catalysis is contrasted with the limited understanding of the fundamental phenomenon, since technical application is based largely on extensive empirical tests. A discussion of the main features of recent researches in hydrogenation catalysis shows the many difficulties involved, including the explanation of the rôle of the *C* factor in the Arrhenius equation which appears to be solely responsible for the large differences in the resulting over-all rates of hydrogenation. The main problem of chemical kinetics is to derive this essentially temperature-independent "frequency" factor from fundamental atomic and molecular data. The experimental work for the first time relates differences in rate quantitatively to differences in crystal parameter of the catalyst and also gives the entirely independent kinetic result that the observed differences in rate must be due to an "entropy of activation" (steric factors). N. M. B.

ELECTROCHEMISTRY 541.13

PHOTOCHEMISTRY 541.14

541.144 589

Determination of free radicals in acetone photolysis. FELDMAN, M. H., BURTON, M., RICCI, J. E., AND

DAVIS, T. W. *J. Chem. Phys.*, **13**, 440–7 (*Oct.*, 1945). —Acetone was photolysed in a flow system at several temperatures in the pressure range 0·5 to 11 mm with exciting radiation of $\lambda = 2\,650$–$2\,900$ Å and 2 537 Å. The free CH_3 radicals formed in the decomposition were determined as $Pb(CH_3)_4$. Approximately one CH_3 radical is formed for every 4 molecules of CO, the actual proportion depending on temperature and pressure. Relatively more free radicals are formed at 100°c than at lower temperatures and more are formed at lower pressure than at high. A process involving the existence of a long-lived metastable state for photoactivated acetone was suggested to explain the results. The proposed scheme is found consistent with most of the published work.

541.145 : 542.952.6 : 541.127 590

Propagation and termination coefficients for vinyl acetate photopolymerization. BURNETT, G. M., AND MELVILLE, H. W. *Nature, Lond.*, **156**, 661 (*Dec.* 1, 1945).

COLLOIDS . ADSORPTION 541.18

541.18 : 535.822.4 = 3 591

Contribution to the problems of the determination of the size and shape of ultramicroscopic particles. HANKE, W. *Z. Phys.*, **121** (*Nos.* 5–8) 438–58 (1943).—The expression for the "visibility function" as the criterion of the observed image of diffraction is developed and discussed, and is applied to the investigation of a parallelogram and a triangle as the figure of the objects. Experimental results are given for the diffraction at the double aperture of finite aperture width. H. G. S.

541.182.5 : 535.822.4 592

Microscopic studies of lyogels: ultra-illumination by incident light. HAUSER, E. A., AND LE BEAU, D. S. *Industr. Engng Chem.*, 37, 786–9 (*Aug.*, 1945).—A new technique is described which permits the microscopic examination of lyogels, particularly of natural and synthetic rubber, with ultra-illumination by incident light. The morphology of the original lyogel and that of its fractions, separated by solvent extraction, can be studied, as well as the changes it undergoes when subjected to chemical reactions or physical forces. Results obtained on rubbers, soap, and other lyogels are discussed. Several photomicrographs are reproduced.

541.182.5 : 539.388.8 *see Abstr.* 571

541.182.5 : 679.5 : 539.501 *see Abstr.* 577

541.182.6 593

Positively charged ferric vanadate sol. MUSHRAN, S. P. *Curr. Sci.*, **14**, 233–4 (*Sept.*, 1945).

541.183 : 538.21 = 4 *see Abstr.* 527

541.183 : 539.23 : 541.128 *see Abstr.* 588

541.183 : 539.233 594

Reversible adsorption of proteins at the oil/water interface. I. Preferential adsorption of proteins at charged oil/water interfaces. ELKES, J. J., FRAZER, A. C., SCHULMAN, J. H., AND STEWART, H. C. *Proc. Roy. Soc. A*, **184**, 102–15 (*July* 23, 1945).—The behaviour of positively and negatively charged oil-in-water emulsions, stabilized with hexadecyl trimethyl ammonium bromide and sodium hexadecyl sulphate respectively in the presence of protein solutions is studied. Under certain conditions proteins adsorb to a charged oil/water interface. The flocculation of the emulsion on the addition of protein is examined and the effect of NaCl on the flocculation range is discussed. The effect of adsorption and desorption on the structure of the protein molecule is studied with haemoglobin. Some applications of the flocculation technique are indicated and the significance of the phenomena described are discussed. L. S. G.

541.183.1 595

Adsorption isotherms from chromatographic measurements. GLÜCKAUF, E. *Nature, Lond.*, **156**, 748–9 (*Dec.* 22, 1945).—[See Abstr. 2430 (1943)].

541.183.2 596

The adsorption of paraffin-chain salts to proteins. II. The influence of electrolytes and *p*H on the separation of gelatin-dodecyl sulphate complexes from aqueous solutions. PANKHURST, K. G. A., AND SMITH, R. C. M. *Trans. Faraday Soc.*, **41**, 630–7 (*Oct.*, 1945).—The investigation of Part I [Abstr. 699 (1945)] was continued with special attention to the effect of various electrolytes over a wide range of *p*H values. The mechanism was examined from the standpoint of the lyotropic series, and the specific adsorption of the ions concerned. Both the "salting-in" effect (constitution of the complex) and the "salting-out" effect (separation of the complex) of the electrolyte depend on the degree of ion adsorption and hydration. About 10% of the protein nitrogens are such that their combination with DS anions is not impaired by reducing *p*H below 3. Increasing electrolyte conc. at low *p*H seems to increase the availability of N atoms.

541.183.56 : 531.724 597

Gas adsorption methods for measuring surface area of adsorbents. EMMETT, P. H. *Industr. Engng Chem.*, **37**, 639–44 (*July*, 1945).—Methods for measuring surface areas by gas adsorption may be subdivided into two groups. The first is based on the postulate of the existence of multilayers of physically adsorbed gas and makes use of adsorption isotherms of gases near their b.p. The second group assumes that the adsorption of a vapour is a combination of monomolecular physical adsorption and of capillary condensation. Published proposals for measuring surface areas by gas adsorption are critically discussed. The use of low-temperature adsorption of a gas, such as N, near its b.p. is the best substantiated procedure so far described, and is capable of yielding reliable values for the surface areas of porous and finely divided materials or even of materials having relatively small surface areas.

541.183.575 598

Water adsorption measurements on silica gel. TAYLOR, R. K. *Industr. Engng Chem.*, 37, 649–52 (*July*, 1945).—In the absence of air, pressure-temperature measurements for SiO_2 gel–water were made, up to about 900 mm pressure, with 1 to 30%

added water. The data give a linear relation on a Cox chart. In the absence of air, no hysteresis was detected for changes of temperature or of composition. In the presence of 10 mm partial pressure of air, no hysteresis is detected for changes of temperature.

CHEMICAL STRUCTURE 541.2/.6

541.23 599

Molecular weight comparisons from density and X-ray data. The atomic weights of calcium and fluorine. HUTCHISON, D. A. *J. Chem. Phys.*, **13**, 383–7 (*Oct.*, 1945).—Molecular wts were compared by combination of the X-ray and density data for the crystals, calcite, diamond, LiF, NaCl and KCl. Assuming the chemical at. wts of C, Cl, K, Li, Na values for the at. wts of Ca and F were calculated. The method consisted of a series of independent calculations from the results of which final weighted average values were taken for the at. wts of Ca and F. This yielded $40{\cdot}0849 \pm 0{\cdot}0030$ and $18{\cdot}9967 \pm 0{\cdot}0013$, respectively. These are probably the most precise values for these constants at the present time. It appears that the determination of at. wts by this method is as reliable as other standard at. wt procedures.

541.24 : 532.133 *see Abstr.* 391

541.24 : 541.64 *see Abstr.* 603

541.24 : 547.96 600

On the distribution of the molecular weights of proteins. JOHNSTON, J. P., LONGUET-HIGGINS, H. C., AND OGSTON, A. G. *Trans. Faraday Soc.*, **41**, 588–93 (*Oct.*, 1945).

541.265 : 539.13 601

Parachors and molecular dimensions. TELANG, M. S. *Curr. Sci.*, **14**, 233 (*Sept.*, 1945).

541.57 : 539.133 *see Abstr.* 541

541.571.3 602

The constitutional difference between α- and β-derivatives of naphthalene. KETELAAR, J. A. A., AND VAN OOSTERHOUT, G. W. *J. Chem. Phys.*, **13**, 448–9 (*Oct.*, 1945).

541.64 : 535.343–1 *see Abstr.* 454

541.64 : 541.24 603

Molecular weight studies on high polymers with the electron microscope. BOYER, R. F., AND HEIDENREICH, R. D. *J. Appl. Phys.*, **16**, 621–39 (*Oct.*, 1945).—Some preliminary results are reported on measurements of molecular weight distributions for polychlorostyrene. Single polymer molecules were isolated by adding a precipitating agent, such as propanol, to a very dilute solution of the polymer in benzene, presumably causing the molecules to coil up. Circular particles ranging in diameter from 15 Å to 500 Å and believed to represent single polymer molecules were obtained on various polymers. The relationship between measured particle diameter and molecular weight is reviewed in some detail. The data appear to favour the concept of a random coil to the extent that particle diameter varies as the square root of the molecular weight. The molecular weight distribution curves obtained are of the expected shape and extent, although the average molecular weights computed from the distribution curves are 4–5 times greater than values measured by an independent method. Finally, the rôle of electrical charges in stabilizing isolated polymer molecules is discussed.

541.68 : 677.31 604

The chemistry and technology of wool. I. Some relationships between the constitution, properties and uses of wool. SPEAKMAN, J. B. *J.R. Soc. Arts.*, **43**, 603–13 (*Oct.* 26, 1945).

542.952.6 : 541.127 : 541.145 *see Abstr.* 590

CHEMICAL ANALYSIS 543/545

545.822 : 771.5 605

Photographic materials for quantitative spectrography. AMSTEIN, E. M. *Engineering*, **160**, 297–300 (*Oct.* 12, 1945).—Concerned principally with the effects of the intrinsic properties of the photographic plate on spectrochemical analysis, a survey is made of this work mainly from the angle of the internal standard method. How the developed densities depend upon the light intensities is first examined, then the method whereby direct use is made of microphotometer readings; the method whereby microphotometer readings are converted into relative intensities is recommended as being least subject to photographic restrictions. After discussion of plate calibration and reciprocity failure, recommendations are made of suitable emulsions and their varying characteristics noted. A. H.

547.96 : 541.24 *see Abstr.* 600

CRYSTALLOGRAPHY 548

548.0 : 535.52/.54 : 549.12 = 4 *see Abstr.* 621

548.0 : 535.54 = 3 606

On the measurements of atomic radiation fields in crystals. II. Calculation of the distribution of the absorption for dipole radiation and determination of the transition probabilities. HELLWEGE, K.-H. *Z. Phys.*, **121** (*Nos.* 9–10) 588–603 (1943).—The earlier qualitative discussion [Abstr. 1450 (1944)] of the atomic dipole moment by dipole groups adapted to the crystal structure is dealt with quantitatively. The dependence on the direction of the ray and that of the vibration of the light of the absorption for given crystal symmetry is determined. The individual dipoles are assumed to be inter-independent as regards their absorption and to be Hertz dipoles in respect to their radiation fields. The absorption is so weak that the incident light wave has practically the same amplitude for all dipoles of a group. In the case of the rare earth salts the distribution of the direction is in agreement with classical crystal optics. The results are used to determine the transition probabilities and oscillator strengths. Measurements are given of experiments carried out on an hexagonal Nd–Zn nitrate. H. G. S.

548.0 : 538.22 *see Abstr.* 531

548.0 : 621.396.611.21 : 537.228.1 *see Abstr.* 497

548.5 : 539.234 = 3 607

On the crystallization of thin films of antimony. LOTMAR, W. *Helv. Phys. Acta*, **18** (*No.* 5) 369-88 (1945).—Thin Sb films deposited by vacuum distillation are amorphous, and brownish by transmitted light. Crystallization proceeds from nuclei, the number of which per cm^2 depends on the nature of the film support and the thickness of the film. It can be increased by treating the freshly deposited film with a current of dust-laden air or a glow discharge. At room temperature the rate of growth of the crystalline regions is approximately a linear function of the film thickness, decreasing from about 7 μ/sec at 500 Å to zero at 180 Å; growth does not continue in thinner films. Crystalline films are bluish by transmitted light, and between crossed nicols show a very detailed spheritic structure, the region about each nucleus having roughly trigonal symmetry. Each 120° sector appears to consist of a large number of small approximately parallel crystals with their *c*-axes inclined at a few degrees to the normal through the nucleus. Electron diffraction and electron microscope photographs lend support to this view. Crystallization proceeds as usual after the removal of a soluble support, the region around each nucleus being then cone-shaped, suggesting the presence of stresses in supported crystalline films. A. J. C. W.

548.524 : 541.127.1 608

Kinetics of sucrose crystallization. Mechanism of reaction. VAN HOOK, A. *Industr. Engng Chem.*, **37**, 782–5 (*Aug.*, 1945).—Frequently it is assumed that a physical process (diffusion or viscosity) is the rate-determining step in the crystallization of sucrose from ordinary syrups. Several workers showed that this is not necessarily so, but that a homogeneous and interfacial (chemical) reaction may be the primary kinetic step. These works are reviewed, and are supplemented with stirring and colloid addition experiments. It is confirmed that a homogeneous surface reaction determines the rate of crystallization.

548.572 : 535.417 : 549.514.51 609

The topography of crystal faces. I. The topography of a (100) face of a left-handed quartz crystal. TOLANSKY, S. *Proc. Roy. Soc. A*, **184**, 41–51 (*July* 23, 1945).—A multiple beam interferometric procedure is described for revealing the details of the surface topography of crystal planes. A discussion is given of the optical conditions which are critical. Details of structure which cannot be detected by the microscope or the goniometer are revealed. The interference fringes which are employed can be used in either transmission or reflection, the latter being well adapted for the examination of translucent or opaque crystals. Face angles which are not more than 0·02 min may be measured. On the quartz crystal studied large vicinal faces, inclined at angles varying from 0·50 to 9·00 min are found to cover the (100) face. The surfaces of most of these faces are curved, the radii of curvature lying between 20 and 60 m. The characteristic visual markings of a (100) face, viz. striations, Λ marks and triangles reveal their influence upon the fringe patterns and their topographical features are determined. The method described may be considered to function in a region intermediate between the microscope and X-rays. L. S. G.

548.572 : 535.417 : 549.623.5 610

The topography of crystal faces. II. The topography of cleavage faces of mica and selenite. TOLANSKY, S. *Proc. Roy. Soc. A*, **184**, 51–63 (*July* 23, 1945).—The method of Part I [Abstr. 609 (1946)] is used, the precision attained being very high especially in the case of mica. Hills and dales, which may extend up to heights and depths of 1/200th mm, are found in all mica specimens. Sharp cleavage lines representing discontinuity in level (i.e. steps) are revealed. The smallest step measured was 41 Å, which is only 2 "molecules." Steps of up to 577 molecules are recorded. Up and down steps occur in a random way. A selenite cleavage surface reveals a large number of long "cleavage lines" which are roughly parallel. The hills and dales shown by mica are absent. The observed steps at the lines vary from 16 to 146 molecules in height, the faces on the adjacent sides of a line (in contrast with mica) being usually inclined to each other. The fringes are very ragged and are nowhere smooth as in mica. This is due to the existence of a secondary structure consisting of a great number of small elongated facets, which are mostly about 0·02 mm wide and vary in level in a random way by only a few "molecules." L. S. G.

548.7 = 3 611

On the structure of water. HAVLIČEK, F. I. *Z. Phys.*, **121** (*Nos.* 5–8) 495–500 (1943).—Starting from the crystal structure of ice and the Debye H_2O molecule the associations in water assumed earlier [*ibid.*, **119**, 677 (1942)] are investigated by means of models based on the lattice of the D_{6h}^4 space group and the resulting behaviour of water explained and the inner energy calculated. H. G. S.

548.73 612

The crystal structure of cholesteryl iodide. CARLISLE, C. H., AND CROWFOOT, D. *Proc. Roy. Soc. A*, **184**, 64–83 (*July* 23, 1945).—An X-ray analysis of the crystal structure was made. The method was to calculate the electron density within the unit cell, using the observed *F* values and, at first, the phase angles derived from the contributions of the iodine atoms alone. The electron density pattern so deduced necessarily has a centre of symmetry. Fourier projections on (010) were derived for both forms of cholesteryl iodide and these show clearly the outlines of the sterol molecules and their general arrangement. The crystal structure derived confirms the general view of sterol crystallography put forward by Bernal and also the present accepted chemical structure of the sterol skeleton. L. S. G.

548.73 613

The absorption displacement in X-ray diffraction by cylindrical samples. WARREN, B. E. *J. Appl. Phys.*, **16**, 614–20 (*Oct.*, 1945).—In the precision determination of lattice constants from back reflection Debye–Scherrer patterns, one of the systematic errors arises from the effect of absorption in the sample. The magnitude and form of the error is calculated for a

cylindrical sample, for both parallel and diverging primary beams, and for a representative variety of values of the absorption coefficient. Calling 2ϕ the back scattering angle ($\phi = 90° - \theta$), it is found that the error in ϕ caused by absorption can be set proportional to ϕ. The form of the absorption correction allows it to be lumped in with the other systematic errors for a linear extrapolation according to either $\Delta d/d = K\phi \tan\phi$ or $\Delta d/d = K \sin^2\phi$. There is some preference for the former.

548.73 614

Structure of kaolinite. BRINDLEY, G. W., AND ROBINSON, K. *Nature, Lond.*, **156**, 661–2 (*Dec.* 1, 1945).

548.73 615

Lattice defects in silver chloride crystals. BURGESS, W. G., AND HIOK, T. K. *Nature, Lond.*, **157**, 19–20 (*Jan.* 5, 1946).

548.73 616

Changes in polycrystalline barium-strontium titanate at its transition temperature. MEGAW, H. D. *Nature, Lond.*, **157**, 20–1 (*Jan.* 5, 1946).—[See Abstr. 3125, 2566 (1945)].

548.73 : 620.193.1 : 532.528 = 3 *see Abstr.* 396

548.73 : 621.317.757 : 517.512.2 *see Abstr.* 365

548.73 : 621.357.7 617

Anodic coatings with crystalline structure on aluminium. TAYLOR, C. S., TUCKER, C. M., AND EDWARDS, J. D. *Trans. Electrochem. Soc.*, **88** (*Prepr.* 9) 7 *pp.* (1945).—[Abstr. 384 B (1946)].

548.73 : 669.15 618

An X-ray study of iron-rich iron-silicon alloys. FARQUHAR, M. C. M., LIPSON, H., AND WEILL, A. R. *J. Iron Steel Inst.*, 14 *pp.* (*Advance copy, Oct.*, 1945).—This work confirmed the main outlines of the α phase boundary found by previous workers, using data from more alloys. At temperatures between 1 030° and 1 195°C the phase boundary was modified by the discovery of a new phase, α'', which calls for modification of the equilibrium diagram. The reaction by which α'' is formed is unusual, and is discussed in detail; by consideration of free-energy principles it is concluded that the reaction is either polymorphic or peritectic, but not peritectoid. A relationship was found between the orientations of the η phase and the α matrix in which it is precipitated; on the basis of this a reason is advanced for the precipitation of η outside its range of stability. The precipitation of η instead of ε was observed particularly in commercial alloys.

548.73 : 669.71.25 619

Unit cell and space-group of Co_2Al_9. PARKER, A. M. B. *Nature, Lond.*, **156**, 783 (*Dec.* 29, 1945).

MINERALOGY 549

549.091.3 620

The identification of gems. PFUND, A. H. *J. Opt. Soc. Amer.*, **35**, 611–14 (*Sept.*, 1945).—5 optical measurements, which can be made on a polished facet $\not< 2{\cdot}5$ mm square without damage to the gem, serve, with the sp. gr., to give a positive identification for 16 gem types.

549.12 : 535.52/.54 : 548.0 = 4 621

Determination of the optical properties of opaque crystals by means of polarizing microscopes. CAPDECOMME, L., AND ORCEL, J. *L'Optique* (*Rev. Opt. Théor. Instrum.*), **20**, 47–114 (1941).—An extensive survey article covering the whole field of the examination of opaque minerals by means of polarizing microscopes. After reviewing the underlying theory the historical development of the subject is given and then a survey of the qualitative methods using both single and crossed polarizers. This is followed by a résumé of recent developments whilst the final section deals with the measurement of reflecting power (together with the various instruments, etc., required for this) and the crystallographic data obtainable from this. The errors inherent in the various methods are discussed. A full bibliography is included. A. H.

549.514.51 : 535.417 : 548.572 *see Abstr.* 609

549.623.5 : 535.417 : 548.572 *see Abstr.* 610

GEOPHYSICS 55

METEOROLOGY 551.5

551.508.11 = 4 622

Cellux balloons. BERGER, P. *Arch. Sci. Phys. Nat.*, **27**, 26–55 (*Jan.–Feb.*), 59–78 (*March–April*, 1945).—This paper concerns the replacement of rubber by cellux for balloon fabrics, and deals with tensions in the balloon cover, balloon shapes, balloon construction, internal pressure, the properties of cellux (which is a derivative of viscose), thermal influence on the extension and resistance to rupture of cellux, diffusion loss, influence of humidity and of water, influence of light, diffraction of X-rays by cellux, deterioration of cellulose, balloon equipment, ceiling (maximum altitude attainable), balloon ascension and velocity, analysis of balloon deformations, and hydro-aerodynamic brakes. The balloons discussed are of such a construction that should they be abandoned fortuitously without a load, they do not rise with their major axes vertical, but roll so that the major axes tend to become horizontal whatever the direction. At high altitudes, the balloons are superior to those made of rubber which are too sensitive to ultra-violet radiation. H. H. HO.

551.521.11 : 535.245 : 778.3 623

A photographic daylight recorder. FARROW, B., AND PELTON, M. O. *J. Sci. Instrum.*, **22**, 210–13 (*Nov.*, 1945).—A description is given of a method for the continuous measurement of daylight. The recording instrument gives a photographic trace of the logarithm of intensity against time which is integrated

to an energy figure by photometric means, an optical wedge being used to reduce the logarithm to intensity. A brief comment is made on the results obtained over a period of nine years.

551.557 624

Wind measurements at 30 km. JOHNSON, N. K. *Nature, Lond.*, **157**, 24 (*Jan.* 5, 1946).

551.57 : 535.243 625

A spectrophotometer for the determination of the water vapour in a vertical column of the atmosphere. FOSTER, N. B., AND FOSKETT, L. W. *J. Opt. Soc. Amer.*, 35, 601–10 (*Sept.*, 1945).—A transmission replica grating is used as the dispersing element and an infra-red-sensitive photo-tube as the energy receiver. The photo-tube current is amplified by a negative feedback d.c. amplifier and is read either by means of a 500 μA meter or recorded by a high speed potentiometer recorder. Measurements are obtained by comparing the radiant flux in the 0·94 μ water vapour absorption band with that at 1·01 μ where no absorption occurs. A single-mirror heliostat is utilized to keep the spectrophotometer focused on the sun. An approximate calibration was obtained by plotting the spectrophotometer ratios against the total precipitable water values in a vertical column of the atmosphere as calculated from radiosonde moisture data. The apparatus is cheap to construct and simple in operation. [See Abstr. 2948 (1943), 2947 (1940)].

551.590.25 : 621.396.812.3 626

Measurement of v.h.f. bursts. *Electronics*, **18**, 105 (*Jan.*, 1945).—[Abstr. 418 B (1946)].

551.594.221 : 537.523.4 627

Measurements by frame aerials of current variations in lightning discharges. NORINDER, H., AND DAHLE, O. *Ark. Mat. Astr. Fys.*, 32 A (*No.* 5) 70 *pp.* (1945).—Following earlier work [see Abstr. 3505 (1937)] on the magnetic field changes produced by lightning discharges to earth an improved, specially shielded, aerial of a few turns only was devised which required a powerful amplifier to record strokes a few miles distant. In order to transform field change records into records of the field itself an integrating device was developed, which is described. Two oscillographs were employed, one of which, with a fast time sweep, was intended to depict the fast field variations and the second, with a slower sweep, to resolve the time sequence of the component strokes in a multiple flash. Many oscillographic examples are reproduced and the number of strokes, and their amplitudes within a flash, are discussed. With certain assumptions as to the mechanism of the return stroke and its relation to the magnetic and radiation field changes produced, current wave shapes are deduced from the oscillographic records obtained and the results are evaluated in the form of frequency distribution curves for the front steepness of the lightning current, its time to crest, the duration of superimposed current oscillations, crest values and durations of currents and charges dissipated in flashes and component strokes, and the number of component strokes. A lightning flash which caused a fatal accident and for which full oscillographic information was obtained is discussed in detail. A qualitative explanation of the typical current wave is proposed. R. H. G.

BIOLOGY 57/59

576.355 : 537.531.9 : 615.84 628

On the effect of Roentgen rays on cellular division. HEVESY, G. *Rev. Mod. Phys.*, 17, 102–11 (*April–July*, 1945).—The effect of X-radiation on the behaviour of the dividing cell is briefly discussed. In rapidly growing tissue mitosis counts, i.e. counts of the number of dividing cells, give information about this behaviour. In cases where this method fails, the effect of ionizing radiations can be studied by comparing the amounts of nucleic acid molecules formed before and after irradiation. X-radiation causes a reduction in the amount of desoxyribose nucleic acid built up in a given time in the tissue, and a disturbance of normal mitosis results. The process can be followed by using radiophosphorus as a means of labelling the newly formed nucleic acid molecules. The formation of desoxyribose nucleic acid is blocked by X-radiation to about the same extent in growing tissue and in normal adult tissue. The inhibiting effect passes away rapidly in a few hours after irradiation. During such a time most cells in a rapidly growing tissue will reach mitosis but only a small fraction will do so in normal full-grown tissue. The growing cell will thus be more sensitive to the radiation and any influences reducing the speed of growth, e.g. lowering of tissue temperature, will reduce the sensitivity to X-rays. The indirect nature of the effect of X-rays on cell division is also discussed. H. M.

591.181 629

Electrical transmission at nerve endings. SINGH, I., AND SINGH, S. I. *Curr. Sci.*, **14**, 244–5 (*Sept.*, 1945).

591.182 630

An electric hypothesis of synaptic and neuromuscular transmission. ECCLES, J. C. *Nature, Lond.*, **156**, 680–3 (*Dec.* 8, 1945).

591.185.5 : 534.321.9 *see Abstr.* 420, 421

MEDICAL SCIENCE 61

612.44 : 539.167.3 = 4 631

Metabolism of thyroxine and ionic iodine. JOLIOT, F. *Proc. Roy. Soc. A*, **184**, 1 (*July* 23, 1945).—A description of a method for preparing thyroxine containing radioactive iodine ($^{131}_{53}I^*$) is given. The latter is prepared by irradiating $^{130}_{52}Te$ with deuterons, thus

$$^{130}_{52}Te + {}^{2}_{1}D \rightarrow {}^{131}_{53}I^* + {}^{1}_{0}n$$

Some biological experiments, using the thyroxine, are described. L. S. G.

612.84 : 535.733 632

The anti-chromatic reflex. HARTRIDGE, H. *Nature, Lond.*, **156**, 666 (*Dec.* 1, 1945).—The chromatic aberration of the eye-lens, leading to coloured images of white objects, is found to be countered by a nervous

reflex (given the above name). It consists apparently of 2 mechanisms. For example, a white spot produces a yellow image, surrounded by a blue halo; the reflex suppresses the blue halo and gives a sensation of white from the yellow spot. [See Abstr. 1780, 1782 (1945)].

612.84 : 615.849 633

Measurement of the diameters of the living eye by means of X-rays. SORSBY, A., AND O'CONNOR, A. D. *Nature, Lond.*, **156**, 779–80 (*Dec.* 29, 1945).

612.84 : 621.32 = 3 634

Comparative examination of the physiological-optical properties of familiar and novel electric lamps. BIRKHÄUSER, R. *Bull. Ass. Suisse Élect.*, **35**, 471–9 (*Aug.* 23, 1944).—Investigates possible causes of the discomfort experienced by certain individuals after working by a "mixed" light or by the light from fluorescent discharge lamps. In particular there are two effects which deserve consideration, viz. (*a*) the false stereoscopic effect, due to the chromatic aberration of the eye, if the source gives light only at widely separated portions of the spectrum; (*b*) flicker and stroboscopic effects. The author suggests that when the flicker frequency is high, although the illumination appears steady, this is no guarantee that the eye is not being affected by the repeated "blows" due to the individual impulses. J. W. T. W.

612.843.4 635

Entoptic mapping of the Purkinje blue arcs. DOLECEK, R. L., AND DE LAUNAY, J. *J. Opt. Soc. Amer.*, **35**, 676–80 (*Oct.*, 1945).—A study of the form of the blue arcs seen in the eye during dark adaptation, using a red source as stimulus on a dark background. Arcs were plotted for 30 different positions of the stimulus. The theory that the arcs follow the course of the papillo-macular nerve bundles is confirmed. J. W. T. W.

615.84 : 537.531.9 : 576.355 *see Abstr.* 628

615.849 : 537.531.8 636

The quantity and quality of the radiations scattered within a medium irradiated by high voltage radiation. WILSON, C. W. *Brit. J. Radiol.*, **18**, 344–55 (*Nov.*, 1945).—The air ionization measurement of dose is discussed and it is shown that the next step is the interpretation of dose in terms of energy absorbed by the tissues. This necessitates knowledge of (*a*) the atomic characteristics of the absorbing tissues and (*b*) the quantity and quality of the scattered radiation in addition to that of the primary radiation. Measurements of the quantity of scattered radiation are described and the relation between the quantity and the material of the medium are discussed. The quantity of scattered radiation found experimentally is compared with that to be expected from a theory based on a single scattering process. It appears that a high proportion of the scattered radiation must arise from multiple scattering, especially with large fields and at considerable depths in the medium. Using earlier data, calculations are made of the effective wavelengths of the scattered radiations in a water phantom for various primary wavelengths, field sizes, and depths. These values are compared with those indicated by the single-scatter theory. The results confirm the conclusions reached through a consideration of the quantity of scattered radiation. The scattered radiations are found to be softest at the surface of the water medium where their wavelengths greatly exceed the primary wavelength. The former become harder as the depth in the medium increases but tend to a const. value at considerable depths. The larger the field size the greater are the effective wavelengths of the scattered radiations, due to increase in the amount of multiple-scattered radiation.

615.849 : 612.84 *see Abstr.* 633

662.61 637

Partial combustion of gas with a deficiency of air. VANDAVEER, F. E., AND SEGELER, C. G. *Industr. Engng Chem.*, **37**, 816–20 (*Sept.*, 1945).—For many heating operations the chemical effect of flue products may be disregarded, but for heat treating and ceramic manufacturing, special care must be given to the composition of the atmosphere surrounding the work. Partial combustion of gas with a deficiency of air was studied for burning natural, butane, and coke-oven gases with variations of air supply from 10–100% of that needed for complete combustion. Limits were established below which combustion was not self-supporting. These were 65% of the required air for natural, 60% for butane, and 53% for coke-oven gas. By the use of additional external heat, these limits were materially lower. Ratios of CO to CO_2 and of CO to H_2 were determined for these gases.

666.1 638

Some methods for the purification of sands for glass-making SHERLOCK, A. *J. Soc. Glass Tech.*, **29**, 268–72 (*Aug.*, 1945).

669.15 : 548.73 *see Abstr.* 618

669.215 : 538.22 *see Abstr.* 533

669.71.25 : 548.73 *see Abstr.* 619

677 : 778 *see Abstr.* 643

677.31 : 539.26 *see Abstr.* 565

677.31 : 541.68 *see Abstr.* 604

678 : 532.739.2 *see Abstr.* 399

679.5 : 536.413 *see Abstr.* 480

679.5 : 539.4 639

Wood cloth and wood-paper laminates. DELMONTE, J. *Brit. Plast.*, **17**, 341–8 (*Aug.*, 1945).—Gives the results of tests made on various forms of laminated materials in this class. The tests covered a range of physical properties (tensile strength, modulus of elasticity, stiffness factor, etc.) and dimensional stability. Conclusions are derived. E. R. A.

679.5 : 541.182.5 : 539.501 *see Abstr.* 577

PHOTOGRAPHY 77

771.35 : 535.8 = 4 640

Experimental comparison of various types of test objects for photographic objectives. PELLIEUX, R. *Rev. Opt. (Théor. Instrum.)*, **22**, 151–60 (*July–Sept.*, 1943).—The various types of test object are described and their relative advantages and disadvantages indicated. It is pointed out that the figure for the limiting resolution of an objective tends to vary with the test object employed, or for a given object with the observer. It is claimed that the greatest consistency is obtained with a modified form of Houdaille test object. A. H.

771.5 : 545.822 *see Abstr.* 605

772 641

Maximum emulsion speed in relation to the developing agent. JAMES, T. H. *J. Franklin Inst.*, **239**, 41–50 (*Jan.*, 1945).—A comparison is made of emulsion sensitivity and gamma values obtained with various developing agents. Seven of the eleven agents tested gave substantially the same values, and the critical size and configuration of the latent-image centre which will just promote development of a given grain must be substantially the same for each of these agents. The other four agents gave definitely lower speed values. A. H.

772 642

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778 : 677 643

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778.15 644

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778.3 : 535.245 : 551.521.11 *see Abstr.* 623

778.3 : 535.89 = 4 *see Abstr.* 476

778.35 645

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778.6 : 539.23 *see Abstr.* 564

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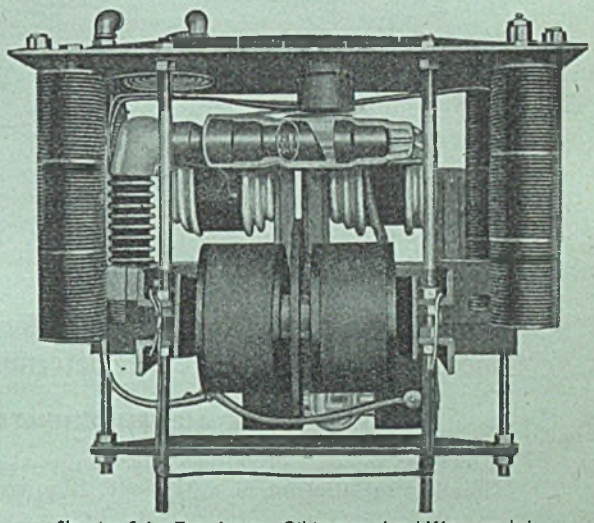

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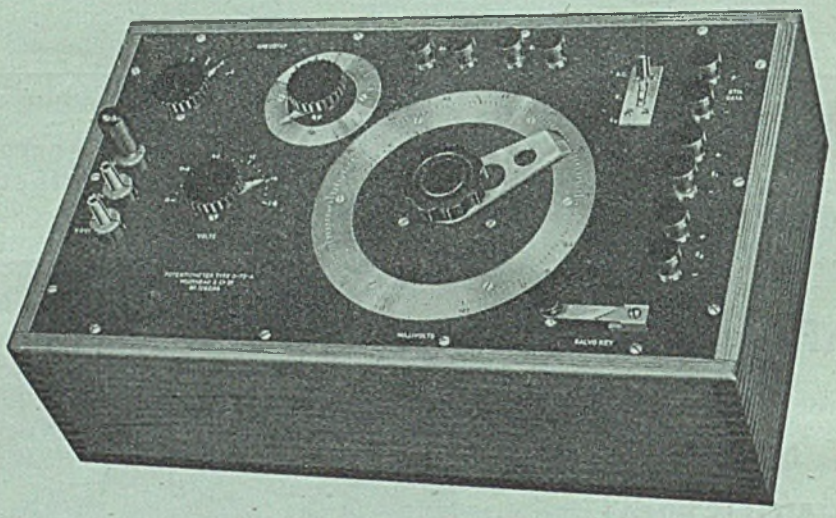

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