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# PHYSICS ABSTRACTS

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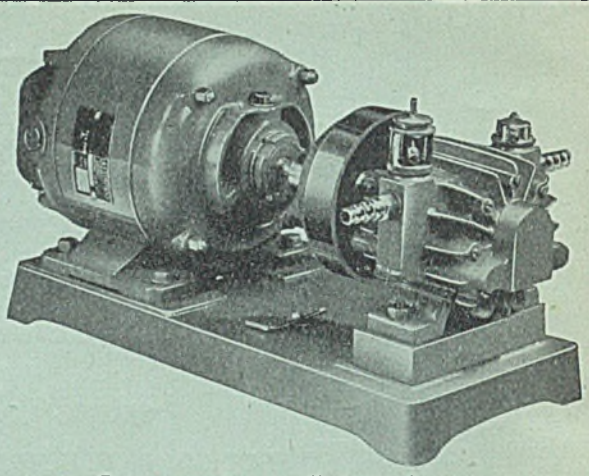

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## NOTE ON THE ARRANGEMENT OF ABSTRACTS

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.

Abstracts signed with the following initials have been supplied by the courtesy of the organizations named: "E. R. A." = British Electrical and Allied Industries Research Association. " M.-V." = Metropolitan-Vickers Electrical Co., Ltd. " P.O." = Post Office Engineering Research Department.

POLITECHNIKA ŚLĄSKA BIBLIOTEKA GŁÓWNA Gliwice

061.3 935

**French Association for the Advancement of Science: Victory Congress.** *Nature, Lond.*, **157**, 198–9 (*Feb.* 16, 1946).

389.6 : 621.386 : 615.849 *see Abstr.* 1185

# MATHEMATICS 51

512.831 : 621.392.5 936

**The application of the characteristic equation of a matrix to the evaluation of the range of frequencies for which currents are passed through networks with four or more terminals without attenuation.** LOWRY, H. V. *Phil. Mag.*, **36**, 255–64 (*April*, 1945).—[Abstr. 871 B (1946)].

512.972 : 621.3 = 4 937

**Applications of the tensor calculus to electrical engineering.** TOURNIER, M., AND CECCALDI, M. *Rev. Gén. Élect.*, **52**, 309–18 (*Oct.*, 1943) *In French.*—[Abstr. 714 B (1946)].

512.972 : 621.392 : 621.3.09 = 4 938

**The application of the tensor calculus to the study of electric networks.** ÉTIENNE, P. *Rev. Gén. Élect.*, **52**, 318–19 (*Oct.*, 1943) *In French.*—[Abstr. 720 B (1946)].

513.614 939

**On multiple curves. III.** HODGE, W. V. D. *Proc. Camb. Phil. Soc.*, **42**, 11–14 (*Jan.*, 1946).—A continuation of previous work [Abstr. 2664 (1945)]. Given a (plane) algebraic curve, $C$, and an Abelian group, $G$, it is shown how a normal multiple curve, $\Gamma$, of $C$, corresponding to $G$, may be constructed. Any normal multiple of $C$ is birationally equivalent to $\Gamma$. L. S. G.

513.766 = 5 940

**Finite connections.** DE MIRA FERNANDES, A. *Portugaliae Mathematica*, **4** (*No.* 4) 203–10 (1945) *In Italian.*—A discussion of Einstein's recent work on affine connections [*Ann. Math.*, **45** (1944)]. Some of the results are derived from a different set of postulates from those originally used. L. S. G.

517.2 : 519.53 941

**A general form of the covering principle and relative differentiation of additive functions. II.** BESICOVITCH, A. S. *Proc. Camb. Phil. Soc.*, **42**, 1–10 (*Jan.*, 1946).—An extension of the results of a previous paper [Abstr. 2668 (1945)], the convergent sequences of concentric circles being replaced by any regular convergent sequences of covering sets. The problem of the differentiation of indefinite integrals with respect to any measure function is solved completely. Indefinite integrals are differentiable at almost all points. In the case of the general measure function, necessary and sufficient conditions are given in order that the derivative be equal to the integrand at almost all points. The subject matter of the paper is treated for the Euclidean plane, but the results hold for $n$-dimensional space. L. S. G.

517.512.2 : 551.501 942

**A summary method in harmonic analysis.** WERENSKIOLD, W. *Met. Ann.*, **1** (*No.* 7) 137–47 (1942).—A method of approximate calculation of the Fourier coefficients of a function given by a number (24) of discrete, equidistant values is explained, suitable when only one or two harmonics are required. The formulae are proved and the accuracy is illustrated by comparison with exact analysis of daily temperature values for Oslo. A misprint gives the mean as $^1/_4$ (instead of $^1/_{24}$) of the sum. J. A. W.

517.53 943

**A formula for the solution of an arbitrary analytic equation.** BLASKETT, D. R., AND SCHWERDTFEGER, H. *Quart. Appl. Math.*, **3**, 266–8 (*Oct.*, 1945).—The theorem proved is: Let $w = f(z)$ be an analytic function, regular in a domain $\Delta$ of the complex $z$-plane. Let $\alpha$ be an interior point of $\Delta$ and a simple root of $f(z)$, that is, $f(\alpha) = 0$, $f'(\alpha) \neq 0$. Further, let $z_0$ be a point of $\Delta$ which is a first approximation to the root $\alpha$. Then, if $z = f^{-1}(w)$ is the inverse function of $f(z)$ and $w_0 = f(z_0)$, we have

$$\alpha = \sum_{\nu=0}^{\infty} (-)^{\nu} \frac{w_0^{\nu}}{\nu!} \left( \frac{d^{\nu} f^{-1}(w)}{dw_0^{\nu}} \right)$$

This theorem provides a basis for an iterative method for approximating to the root $\alpha$. L. S. G.

517.947 944

**On relaxation methods: A mathematics for engineering science.** SOUTHWELL, R. V. *Proc. Roy. Soc. A*, **184** (*No.* 998) 253–88 (*Aug.* 21, 1945).—In this, the Bakerian lecture to the Royal Society for 1943, the author traces the development and application of relaxation methods. A large number of examples is given. These are taken mostly from various papers in the series on relaxation methods by the author and his school. A complete bibliography of the series to date is given. L. S. G.

517.947 : 531.252.2 945

**Relaxation methods applied to engineering problems. VII B. The elastic stability of plane frameworks and of flat plating.** CHRISTOPHERSON, D. G., FOX, L., GREEN, J. R., SHAW, F. S., AND SOUTHWELL, R. V. *Philos. Trans. A*, **239** (*No.* 810) 461–87 (*Oct.* 10, 1945).—The method given in paper VI of the series [Abstr. 1997 (1940)], for computing normal modes and associated frequencies of vibration, is developed and extended to investigate the problem of the critical loadings and the associated modes of distortion for plane frameworks and for flat plating when there is neutral elastic stability. For flat plating it is difficult to conjecture even approximately the mode associated with the gravest critical loading and it was necessary to develop a special technique to cope with this. This is called optimal synthesis and consists in a systematic blending of two solutions, each of which satisfies the imposed boundary conditions. Two

examples are given, the computational work being discussed in detail. One of these relates to a rectangular plate sustaining thrust on one pair of edges. The other concerns a rectangular strip sustaining bending moments accompanied by shear. L. S. G.
517.947 : 531.252.3 946

**Relaxation methods applied to engineering problems. VII D. Stress distributions in elastic solids of revolution.** ALLEN, D. N. DE G., FOX, L., AND SOUTHWELL, R. V. *Philos. Trans. A*, 239 (*No.* 810) 501–37 (*Oct.* 10, 1945).—It is shown that relaxation methods can deal successfully with all the problems covered analytically by Southwell [Abstr. 2270 (1942)], which are: (1) torsional stresses in an incomplete tore, (2) torsional stresses in a circular shaft of non-uniform diameter, (3) axially symmetric stresses in a complete solid of revolution, (4) flexural stresses in an incomplete tore, (5) shearing and flexural stresses in a toroidal "hook." A numerical example is given in each case. Moreover, in the relaxation method there is no restriction on the form of the generating curve, so that this method provides the only practical means of investigating stresses in solids of revolution. L. S. G.
517.947 : 531.258 947

**Relaxation methods applied to engineering problems. VII A Biharmonic analysis as applied to the flexure and extension of flat elastic plates.** FOX, L., AND SOUTHWELL, R. V. *Philos. Trans. A*, 239 (*No.* 810) 419–60 (*Oct.* 10, 1945).—Biharmonic analysis and the solution of $\Delta^4 w = W$, where $W$ is a specified function, are brought within the range of the relaxation method. The theoretical basis for this is discussed, including the various finite-difference approximations to the equation mentioned. The relaxation patterns for the operators $\nabla^2$ and $\nabla$ are given in the case of triangular and square networks. The interlacing of nets and the treatment of a double boundary condition is considered. In the application special attention is given to the problem of a flat elastic plate which is either bent or stretched. Four cases are treated, since the edge conditions may specify either tractions or displacements both in the flexural and in the extensional problem; one example of each is considered. Only slight modification of the method is apparently needed to deal with acolotropic plates. The method of this paper, while laborious, is not more so than the photo-elastic technique which, at present, appears to be the sole alternative. L. S. G.
517.947 : 531.258 948

**Relaxation methods applied to engineering problems. VIII A. Problems relating to large transverse displacements of thin elastic plates.** GREEN, J. R., AND SOUTHWELL, R. V. *Philos. Trans. A*, 239 (*No.* 811) 539–78 (*Nov.* 6, 1945).—Four problems are solved, (*a*) a circular plate, with clamped edge, which sustains a uniform transverse pressure, (*b*) a circular plate, with "simply supported" edge, which buckles with radial symmetry under uniform edge thrust, (*c*) a square plate (sustaining uniform transverse pressure) of which the edges are clamped, (*d*) a square plate buckled by actions which, clamping its edges, tend initially to induce a state of uniform shear. The first two examples may be solved analytically (and so serve as test cases) but the last two present great difficulties in this approach, since the large-deflection equations of von Kármán are intractable in most cases. Rayleigh's principle is extended to apply to large deflections and appears likely to have considerable value in design problems. L. S. G.
517.947 : 534.121.2 : 621.396.611.4 949

**Relaxation methods applied to engineering problems. VII C. Free transverse vibrations of membranes, with an application (by analogy) to two-dimensional oscillations in an electromagnetic system.** ALLEN, D. N. DE G., FOX, L., MOTZ, H., AND SOUTHWELL, R. V. *Philos. Trans. A*, 239 (*No.* 810) 488–500 (*Oct.* 10, 1945).—Membranes, of uniform or variable density, are easily treated by a technique similar to that of VII B [Abstr. 945 (1946)]. The governing equation, in the case of uniform density, is $\nabla^2 w + \lambda w = 0$ and this is just the type of equation arising in the electromagnetic application. The modes of oscillation in a cavity resonator may thus be treated by the relaxation method. An example given relates to the resonator system of a klystron tube. L. S. G.
519.21 = 3 950

**The experience effect in probability theory.** HADWIGER, H. *Experientia*, **1**, 87–9 (*June* 15, 1945) *In German.*—A study is made of the variation, with time, of a probability $p(t) = A(t)\{A(t) + B(t)\}^{-1}$, where $A(t)$ is the weight of the desired cases and $B(t)$ the weight of the undesired cases. When $A(t)$ is a constant, $A(0)$, and $B(t)$ varies according to the formula,

$$B(t)/B(0) = 1 - \lambda \int_0^t \{1 - p(\xi)\} d\xi$$

it is found that $p(t)$ satisfies the differential equation, $p' = \omega\lambda(p^2 - p^3)$ where $\omega = B(0)/A(0)$. A study is made of the solution of this equation. An asymptotic solution, for large $t$, is given and a power series for $1/p(t)$ is obtained. L. S. G.
519.212 = 4 951

**A hypothesis of the identity of coarse and fine as a basis of statistics.** MERCIER, A. *Experientia*, **1**, 92 (*June* 15, 1945) *In French.*
519.214 952

**On the accumulation of chance effects and the Gaussian frequency distribution.** GRIMSEY, A. H. R. *Phil. Mag.*, 36, 294–5 (*April*, 1945).—It is pointed out that a certain integral appearing in a previous paper, of the same title [Abstr. 75 (1945)] may be evaluated exactly. Numerical values of the integral are given. L. S. G.
519.241 : 677.01 : 531.751 *see Abstr.* 1003
519.25 953

**Random distribution of lines in a plane.** GOUDSMIT, S. *Rev. Mod. Phys.*, 17, 321–2 (*April–July*, 1945).—A plane is covered with straight lines distributed at random in position and direction. The problem is to calculate the probability distribution of the areas of the polygons into which the plane is divided. This is done exactly for the simplified problem where the lines are all parallel to the $x$-axis or the $y$-axis. For the general problem a sphere is considered instead of a plane in order to avoid difficulties with infinities. L. S. G.
519.283 : 620.113 954

**Statistical methods in quality control. VII. Control charts for analysis of variables.** *Elect. Engng, N.Y.*, 64, 448–50 (*Dec.*, 1945).—[See Abstr. 372 (1946)].
519.53 : 517.2 *see Abstr.* 941

521.91 : 535.225 = 3 *see Abstr.* 1025

522.21 955

**Some advantages of long focus Newtonians.** WHITE, E. K. *J.R. Astr. Soc. Can.*, **39**, 307–10 (*Oct.*, 1945).—This paper outlines the advantages in the making and performance of f/12 mirrors over the more common f/8. For short focus mirrors parabolizing is necessary to correct spherical aberration but the allowable tolerance for long focus mirrors is so much greater that a spherical mirror will give good results. Long focus mirrors give high magnification without costly eyepieces of short focal length and temperature changes are less important. The disadvantages of long focus mirrors are few and not serious, such as length of tube and height of eyepiece. Tube currents have not been found to be increased. A description of the performance of long focus mirrors as compared with those of short focus on different classes of celestial objects is given. E. G. M.

522.6 : 535.42 *see Abstr.* 1045

523.11 : 530.12 *see Abstr.* 981

523.72 : 551.510.535 = 3 *see Abstr.* 1169

523.72 : 621.396.821 956

**Radio-frequency energy from the sun.** PAWSEY, J. L., PAYNE-SCOTT, R., AND MCCREADY, L. L. *Nature, Lond.*, **157**, 158–9 (*Feb.* 9, 1946).—[Abstr. 897 B (1946)].

523.746 957

**Magneto-hydrodynamic waves and sunspots.** ALFVÉN, H. *Mon. Not. Roy. Astr. Soc.*, **105** (*No.* 1) 3–16 (1945).—A summary of earlier work by Alfvén [Abstr. 460 (1945)] and Walén on the application of the theory of magneto-hydrodynamic waves to sunspots, followed by an interpretation of sunspot observations on the basis of the theory. A "sunspot zone progression curve," showing the displacement of the sunspot zone towards the solar equator, is obtained by plotting an average time for the appearance of sunspots in a certain solar latitude against this latitude. This is compared with the rate of progress of the sunspot zone towards the equator calculated on the hypothesis that the sunspots are carried from the interior of the sun to the sun's surface as a magneto-hydrodynamic wave originating from a single disturbance near the sun's centre. The best results are obtained if the sun's general magnetic field is assumed to be uniform within a concentric shell of radius $2 \times 10^{10}$ cm and to be that of a dipole outside this shell, the "sun's magnetic dipole moment" being of the order of $1{\cdot}5 \times 10^{33}$ to $6{\cdot}2 \times 10^{33}$ gauss.cm$^3$. V. C. A. F.

523.746 : 621.396.812.5 958

**The great sunspot and radio transmission.** *Nature, Lond.*, **157**, 155 (*Feb.* 9, 1946).—[Abstr. 895 B (1946)].

523.755 = 3 959

**The behaviour of the coronal line 5 694·42 Å.** WALDMEIER, M. *Astr. Mitt., Zürich* (*No.* 146) (1945) *In German.*—The line (ascribed by Edlen to Ca XV) is seen only above sunspot groups, usually of great activity, and its frequency of observation follows the 11-year cycle. Its highest intensities are observed in prominence heads and eruptions. The reason is found in the abnormally large ionization energy required (814 V). T. G. C.

523.755 : 551.510.535 = 3 960

**The physical state of the sun's corona.** WALDMEIER, M. *Mitt. Aargau. Naturf. Ges.*, **22**, 185–201 (1945) *In German.*—The coronal temperature is calculated from (1) the density-gradient, (2) the complete blurring of Fraunhofer lines in scattered light, (3) the degree of ionization, (4) the intensity of coronal lines, (5) their Doppler widths. The different methods all indicate a temperature of order $10^{6}$°. Coronal radiation is suggested as the chief cause of the ionosphere. T. G. C.

523.755.088.23 961

**A possible source of error in the photographic photometry of the solar corona.** BARBER, D. R. *Mon. Not. Roy. Astr. Soc.*, **104** (*No.* 6) 335–9 (1945).—In photographs of a dark object surrounded by a light background, a spurious radial density gradient may be introduced during the development, extending up to 5 cm from the image of the object. Applications to eclipse photography are considered. T. G. C.

523.77 962

**Intensities of hydrogen Hα and helium $D_3$ in solar prominences. II.** BRÜCK, H. A., AND MOSS, W. *Mon. Not. Roy. Astr. Soc.*, **105** (*No.* 1) 17–22 (1945).—A continuation of earlier work [Abstr. 45 (1944)]. Observations of line-intensities in 21 prominences are quoted. These confirm the earlier result, that variations in relative intensity of Hα and $D_3$ can in general be explained as curve of growth effects, with a temperature of 5 000°K. Variations of excitation are, however, possible in particular cases. T. G. C.

523.82 963

**On the relation of the Cape magnitudes to the International System.** STOY, R. H. *Mon. Not. Roy. Astr. Soc.*, **104** (*No.* 6) 317–25 (1944).—This paper gives the results of observations of the Pleiades and a comparison of the photographic magnitudes of stars in this cluster and in the Hyades and Praesepe with the corresponding Harvard magnitudes which were directly compared with the Polar Sequence. A zero-point correction is derived but no satisfactory reduction to the International System is possible. Certain difficulties found from the use of diffraction gratings in photometry are mentioned. The necessity for observations of a number of standard regions for the southern hemisphere is stressed and the time necessary to carry out a planned programme is assessed. [See Abstr. 964 (1946)]. E. G. M.

523.82 964

**The Cape magnitudes and the International System.** SEARES, F. H., AND JOYNER, M. C. *Astrophys. J.*, **102**, 281–308 (*Nov.*, 1945).—This paper gives the results of the reduction of Cape magnitudes by Stoy and Menzies for the Harvard Standard Regions at declination −45° to the International System. The results of the Mount Wilson observation of Eros stars compared directly with the North Polar Standards have been used as an intermediate link. Agreement is found with Stoy's provisional reduction to about the eighth magnitude, but both photographic and

photovisual scales diverge beyond this point. The zero-points as reduced by Stoy for the Hyades and Praesepe clusters are correct. Stars in the Hyades beyond 200 parsecs show colour excesses of 0·3 magnitudes. This agrees with Ramberg's computation of an obscuring cloud beginning at 140 parsecs. [See Abstr. 963 (1946)]. E. G. M.

523.83 : 523.873 *see Abstr.* 973

523.841.37 : 523.875 *see Abstr.* 975

523.841.9 965

**A spectrographic study of 68 u Herculis.** SMITH, B. *Astrophys. J.*, **102**, 500–10 (*Nov.*, 1945).—The paper gives results of a new determination of the orbital elements from 181 Yerkes spectrograms, the lines of the secondary being measured on two-thirds of the photographs. Values for $\gamma$ and $K$ differ slightly from the 1935 results but $\omega$ shows a large increase which is of doubtful importance, the value of $e$ being small. A difference of 10° between zero phase for the primary and secondary is indicated from the least squares solution of the primary. E. G. M.

523.842 966

**The spectroscopic orbit of TU Monocerotis.** DEUTSCH, A. J. *Astrophys. J.*, **102**, 433–7 (*Nov.*, 1945).—The spectroscopic orbit of TU Monocerotis has been determined from 27 spectrograms. The light curve by Hertzsprung is of the Algol type with a 5 day period. Measures on the spectrograms using lines of He I confirm the period, but hydrogen lines give velocities which scatter widely about the $\gamma$ axis of the He I velocity curve. The spectra indicate a brighter secondary star than the photometric elements would permit. E. G. M.

523.85 967

**Nebulous objects in the Andromeda nebula.** SEYFERT, C. K., AND NASSAU, J. J. *Astrophys. J.*, **102**, 377–81 (*Nov.*, 1945).—Photographic magnitudes have been obtained for 212 of the 249 nebulous objects in M 31 using observational material provided by Baade as well as Hubble's observations of 1932. It is found that Hubble's magnitudes for 148 of these objects are systematically too bright by 0·3 mag. Using the distance modulus of 22·3 for M 31, the mean absolute magnitudes for these objects is −5·0 and the brightest has an abs. mag. of −7·3. Since the average abs. mag. for the globular clusters of the Galaxy is −7·5, it seems doubtful whether the nebulous objects in M 31 are in fact globular clusters. As these objects are probably not single stars, the stellar luminosity distribution must be modified. Star counts of M 31 now reveal no stars brighter than apparent magnitude 16·5 or abs. mag. −5·8.

G. C. McV.

523.854.1 968

**Dimensions of the Galaxy as defined by the system of globular clusters.** HOGG, H. S. *J. R. Astr. Soc. Can.*, **39**, 289–306 (*Oct.*, 1945).—The paper contains a summary of present knowledge of these objects. The 96 globular clusters of the Galaxy have a colour class of G on the average and contain stars of Baade's type II (abs. mag. not greater than −1·5). The distances of these systems and their distribution in space show that the centre of the Galaxy is possibly at not more than 8 000 parsecs from the sun. Distances normal to the galactic plane are comparable with distances along it so that the clusters fill a roughly spherical volume. NGC 2419 is an exceptional object lying at 56 000 parsec from the sun in a direction opposite to the galactic centre. Comparing a globular cluster with an elliptical nebula, the author points out that there is a discontinuity of size but not of stellar content between these two types of object. G. C. McV.

523.87 969

**Spectrum of β Coronae Borealis.** HILTNER, W. A. *Astrophys. J.*, **102**, 438–69 (*Nov.*, 1945).—A high-dispersion spectrogram, obtained at the McDonald Observatory, has been measured for wavelengths and intensities in the region λλ3980–4638. Some 1 560 lines are listed together with their intensities and identifications. A separate list of the stronger unidentified lines is also given. Intensity tracings of the spectral region λλ3987–4642 are given in thirteen figures. G. C. McV.

523.87 970

**The problem of U Coronae Borealis, RS Vulpeculae and TV Cassiopeiae.** SAHADE, J., AND STRUVE, O. *Astrophys. J.*, **102**, 480–91 (*Nov.*, 1945).—At principal minimum the spectra of U CrB and RS Vul show faint lines of Fe I, Fe II, Ca I and Sr II, suggesting that the types of the secondaries are about A2. This confirms the discrepancy between the photometric and the spectrographic types announced previously. The reflection effect cannot account for this discrepancy, but the existence of a peculiarity in the structure of the H lines of U CrB near maximum radial velocity suggests that a stream of gas similar to that previously observed in AU Mon may account for the otherwise unexplained early type of the secondary spectrum. If this should be true, the eclipse would be partial, and the true spectrum of the secondary unobservable; the metallic lines at minimum would then be attributed to the absorption of the light of the partly eclipsed primary by the atoms of the stream. D. S. E.

523.872 971

**Measurements on the spectra of U Orionis, R Serpentis, R Aquilae and R Cassiopeiae.** MERRILL, P. W. *Astrophys. J.*, **102**, 347–52 (*Nov.*, 1945).—First of a series of papers on the spectra of long-period variable stars observed with a dispersion of 10 A/mm. The displacements of groups of lines are accurately measured; most residuals are within the errors of measurement, but a few larger ones are related more to the behaviour of lines of various excitation levels than to differential motions of atoms. In U Orionis before maximum H$\delta$ in emission is notched by an absorption line tentatively identified as due to In I. H$\delta$ may be exciting atoms by fluorescence to the upper level of In I λ4511 which appears as a sharp bright line of moderate intensity. D. S. E.

523.872 972

**The spectrum of Nova Puppis 1942.** SANFORD, R. F. *Astrophys. J.*, **102**, 357–65 (*Nov.*, 1945).—65 spectrograms of Nova Puppis 1942 were obtained between November 11, 1942, and November 28, 1944. Emission lines due to H were observed throughout, those due to Ca II, N II, Si II, O I, O II, Fe II during early part of series of observations being mainly replaced by lines due to higher ions of the same atoms

later. The emission lines split into several components with separate maxima at the end of November 1942. The velocity of expansion as deduced from emission lines was 1 150 km/sec at first, falling to 615 km/sec in 1944. Velocity of the nova as a whole deduced from bisection of emission lines was ±(36·8 ±2·1) km/sec. Measures of widths and strengths of interstellar Ca lines give a distance of 1 460 parsecs and an absolute magnitude at maximum of approximately −10. This value lies between the usual values for bright galactic novae and for supernovae. D. S. E.

523.873 : 523.83 973

**Radial velocities and spectral classes for some stars of large proper motion.** LUYTEN, W. J. *Astrophys. J.*, **102**, 382–4 (*Nov.*, 1945).—The observations were made with the 82-in McDonald telescope and the 1-prism quartz spectrograph and f/1 Schmidt camera. 14 stars with photographic magnitudes between 10·1 and 13·6 were measured for both spectral class and radial-velocity. 8 more stars were measured for spectral class only. Radial-velocities range from +65 to −130 km/sec. Estimates of spectral class are rough. G. C. McV.

523.873 : 537.228.5 974

**The Stark effect of the helium lines 4 471·6 and 4 470·2 in spectra of class B stars.** VERWEIJ, S. *Proc. Ned Akad Wet.*, **43** (*No.* 8) 1000–10 (1940).—In Amsterdam Publication No. 5 Verweij calculated the broadening of the Balmer lines due to intermolecular Stark effect. The work is now carried on to the helium lines 4 472 and 4 470 by very similar methods. Tables of the line absorption coefficients (including Doppler effect for various temperatures) are given for various wavelengths within the lines. Integrations through model stellar atmospheres are carried out to give the variation with gravity. Line profiles are derived and considered in relation to the observations of Foster and Douglas. Width of line wings is computed and compared with observations of Elvey. The ratio of the total absorptions of the two lines is suggested as a good indicator of surface gravity. D. S. E.

523.875 : 523.841.37 975

**The spectra of the cepheid variables.** STRUVE, O. *Observatory*, **65**, 257–73 (*Dec.*, 1944).—Investigation of the spectra of supergiants gives values of surface gravity far below expectation. Pannekock and Reesinck's work suggests similar conclusions for cepheids. There are however marked discrepancies in values of electron pressure in the outer layers of cepheids as deduced by various methods. The literature on the variation of spectral type with phase is briefly reviewed and methods of inferring surface gravity from intensity changes of spectral lines are considered. Discrepancies between the radius variation envisaged by the pulsation theory, and the range of luminosity and colour temperature are discussed. Struve's observations of seven cepheids in Cygnus are discussed, and the interpretation of the velocity curves of cepheids as due to pulsation is considered. D. S. E.

523.877 976

**The natural philosophy of stellar structure.** MILNE, E. A. *Mon. Not. Roy. Astr. Soc.*, **104** (*No.* 2) 146–62 (1945).—A review of the present position in the subject, with a restatement of the author's views on the importance of surface opacity [see Abstr. 519 (1938), 1161 (1932), 1382 (1930)].

523.877 977

**Identification of the post-maximum lines in the spectrum of Nova (RS) Ophiuchi.** JOY, A. H., AND SWINGS, P. *Astrophys. J.*, **102**, 353–6 (*Nov.*, 1945).—The Mount Wilson spectrographs of this nova taken between Sept. 2 and Nov. 10, 1933, have been analysed again in the light of current knowledge of forbidden transitions. The atoms of He, C, N, O, Ne, Na, Si, S, A, K, Ca, Sc, V, Fe, Ni, Kr in various states of ionization have been identified. Of these [A XI] λ6919, [Ca VII] λ3688, [Sc VII] λ4823, [Kr III] λ6827 and possibly [V VIII] λ3686 have been identified for the first time. A comparison of the intensities of the [Fe X] and [Fe XIV] lines shows that the excitation in the layers of RS Ophiuchi in which these lines originate is definitely lower than in most regions of the solar corona. G. C. McV.

523.877 978

**The radiative equilibrium of an expanding planetary nebula. I. Radiation pressure in Lyman-α.** CHANDRASEKHAR, S. *Astrophys. J.*, **102**, 402–28 (*Nov.*, 1945).—The problem of the radiative equilibrium in Lyman-α of a differentially expanding nebula is formulated afresh, special attention being given to the formulation of the boundary conditions. Solutions of the resulting equations for a rectangular form of the absorption coefficient shows that when the Doppler shift due to the difference in velocities between the inner and outer boundaries exceeds the line width by a factor of about 3·5, the nebula may be divided into three regions: an inner, a central and an outer part. The radiation pressure in Lyman-α in the central part is of the same order as that of the continuum, whilst at the "edges" it is still appreciable. The bearing of this effect on the dynamics of a planetary nebula is indicated. V. C. A. F.

523.877 979

**On the integration of the equations determining the structure of a star.** HOYLE, F. *Mon. Not. Roy. Astr. Soc.*, **105** (*No.* 1) 23–9 (1945).—A method of integrating the equations inwards from a point near the surface to the centre is described. The method applies to a model with convective core whose energy is generated in the core. It is shown to give results consistent with those of outward integration. T. G. C.

# PHYSICS 53

## FUNDAMENTALS 530.1

530.12 980

**Phase space in Eddington's theory.** COLEMAN, A. J. *Phil. Mag.*, **36**, 269–78 (*April*, 1945).—A discussion is given of phase space and its place in Eddington's Relativity theory of protons and electrons and in the theory of the calculation of the fundamental constants. The whole volume of the phase space is required to be

finite in Eddington's theory, but the present paper shows that the volume must be infinite. Two ways of avoiding the difficulty are suggested. L. S. G.

530.12 : 523.11 981

**A new approach to kinematic cosmology.** INFELD, L., AND SCHILD, A. *Phys. Rev.*, 68, 250–72 (*Dec.* 1 *and* 15, 1945).—The kinematical aspect of relativistic cosmology is examined on the basis of 3 postulated requirements: The constancy of the velocity of light, spatial isotropy, and homogeneity. Three distinct types of cosmological models are obtained, characterized by different motions of nebulae. The metric of any universe is conformal to Minkowski space and Maxwell's equations are the same for all possible universes. It is shown that the cosmological models are metrically, though not topologically, equivalent to those of H. P. Robertson [Abstr. 1342 (1930)]. Next, special models are examined and their line elements brought into the conformal-Minkowskian form. The problem of the displacement of the lines of nebular spectra is discussed; formulae are obtained and applied to some special cosmological models. Finally, idealized experiments are described which indicate the physical content of the cosmological co-ordinates.

530.14 982

**A study of the nature of the field theories of the electron and positron and of the meson.** FLINT, H. T. *Proc. Roy. Soc. A*, 185, 14–34 (*Jan.* 10, 1946).—The field theories are developed, in close analogy with that of the photon, by representing the tracks of the particles by means of null-geodesics in a five-dimensional space; the use of the latter is satisfactory in that the lengths $h/m_0c$ and $e^2/m_0c^2$ occur naturally without reference to the structure of the particles, and the concept of quantization of electric charge is also included. The energy, momentum and current density are united in a single tensor. A certain arbitrariness exists and if this is removed by making a definite choice of the magnitude of the magnetic moment of the electron and positron, the spin angular momentum is fixed at the value $\frac{1}{2}\hbar$. L. S. G.

530.145.1 = 3 983

**On the interaction between two nucleons in the meson theory.** FIERZ, M. *Helv. Phys. Acta*, 17 (*No.* 3) 181–94 (1944) *In German.*—Using the symmetrical meson theory with strong coupling, the Hamiltonian function for 2 nucleons, due to Wentzel [Abstr. 656, 1380 (1944)], is written down. The properties of various differential operators are noted and these are used to construct certain matrices which allow the Hamiltonian to be transformed into a form more suitable for applications. L. S. G.

530.145.6 984

**Relativistic wave equations for the elementary particles.** BHABHA, H. J. *Rev. Mod. Phys.*, 17, 200–16 (*April–July*, 1945).—The general structure of relativistically invariant wave equations of the form $(p_k a^k + \chi)\psi = 0$ is investigated, it being postulated that all properties of the particle should be derivable without the help of any auxiliary conditions. The equations investigated by Dirac, Fierz and Pauli for spins greater than 1 do not satisfy this requirement. It is shown that all irreducible representations of the spin matrices in the above equation satisfying the condition $[\alpha_m, \alpha_n] = I^{mn}$ can be obtained from the irreducible representations of the orthogonal group in five dimensions. The wave functions do not in general satisfy a second-order wave equation in the absence of interaction, but one of a higher order. A consequence of the equations is that every particle of spin greater than 1 must appear with several values of the rest mass which are multiples of the lowest value. For example, a particle of spin $^3/_2$ must have two values of the mass, one three times the other, and a particle of spin 2 also two values of the mass, the higher double the lower. These higher values of the mass are a necessary feature of the theory and cannot be eliminated.

530.145.6 = 3 985

**On the deuteron problem. I.** FIERZ, M., AND WENTZEL, G. *Helv. Phys. Acta*, 17 (*No.* 3) 215–32 (1944) *In German.*—A study is made of the two nucleon problem on the basis of a theory which ascribes a spin inertia to the nucleon so that it possesses an excited (isobaric) state. The nucleon model is essentially that of the symmetrical meson theory. If the energy of excitation is not very large compared with the mean energy of interaction there is a considerable deviation from the earlier deuteron theory. To solve the wave mechanical problem in this case two processes of approximation are used—the adiabatic method and the variational method. An application is made to the deuteron state with vanishing spin ($J = 0$) or with vanishing isotopic spin ($K = 0$). L. S. G.

530.145.6 = 3 986

**On the deuteron problem. II.** WENTZEL, G. *Helv. Phys. Acta*, 17 (*No.* 4) 252–72 (1944) *In German.*—A continuation of a previous paper [Abstr. 985 (1946)]. The states now studied are those given by $K = 0$, $J = 1$ and by $J = 0$, $K = 1$. These may be identified with the well-known $^3S$ and $^1S$ deuteron states. The spin-charge character and the excitation energies of these two states are discussed. L. S. G

530.145.63 = 4 987

**Functional mechanics.** STUECKELBERG, E. C. G. *Helv. Phys. Acta*, 18 (*No.* 3) 195–220 (1945) *In French.*—The classical theory of the electron and the theory, due to Heisenberg, of observable quantities associated with elementary particles, together allow the establishment of a functional mechanics. In the classical, non-quantized, form the forces are functionals of the history, and this type of mechanics may be interpreted in quantum theory. To characterize a problem by a matrix two principles of correspondence are necessary. These are explained. The new mechanics permits a treatment of all problems in atomic physics such as collisions, radiation, etc. The theory of stationary states of a system of elementary particles is discussed. L. S. G.

## MECHANICS OF SOLIDS 531

531.21 = 69 988

**Study of statically indeterminate structures by Castigliano's theorems and by Beggs's method.** ROCHA, M. *Tècnica* (1943). *Publ. Centro Estud. Engenharia Civ.* (*No.* 1) 76 *pp.* (1943) *In Portuguese.*—Hooke's law is stated in generalized form and ex-

plained and Maxwell's law of reciprocity is deduced. Expressions for the work of deformation are given. These laws are applied to various structures and extended to cases of a couple of given moment. Castigliano's first theorem, concerning the partial derivatives of the elastic deformation energy, is applied to lattice girders, continuous beams and a number of 2- and 3-dimensional statically indeterminate structures. Applications of Castigliano's second theorem to structures internally indeterminate and externally determinate are given, and Beggs's experimental method using micro-measurements on models is explained. J. A. W.

531.224 : 621.774.034.3 : 620.174.2 = 3 989

**Measurement of expansion curves of pipe lines.** SCHMIDT, E. *Schweiz. Arch. angew. Wiss. Tech.*, **10**, 234–41 (*Aug.*, 1944) *In German.*—[Abstr. 705 B 1946)].

531.252 990

**A note on certain stress distributions in isotropic and aeolotropic materials.** GREEN, A. E. *Proc. Camb. Phil. Soc.*, **41**, 224–31 (*Oct.*, 1945).—The methods of various authors [Abstr. 1998 (1945), 827 (1944), 2151 (1942), 3499 (1938)] are reviewed and attention is redirected to problems of stress distributions in semi-infinite isotropic media, using a complex variable approach. The analysis is developed for generalized plane stress. L. S. G.

531.252.2 991

**Stress systems in isotropic and aeolotropic plates. V.** GREEN, A. E. *Proc. Roy. Soc. A*, **184** (*No.* 998) 231–52 (*Aug.* 21, 1945).—A theoretical solution is given for problems of stress distributions in isotropic and aeolotropic plates containing holes of various shapes. In the isotropic case the solution is used to discuss stress distributions near rectangular holes and near holes represented by the equations

$$x = na\cos\xi + b\cos n\xi,\quad y = -na\sin\xi + b\sin n\xi$$

Numerical results are given for the cases $n = 3$, $a = 3b$, which represents a square with rounded corners, and for the case $n = 2$, $a = 2b$, which represents an equilateral triangle with rounded corners. Well-known results for an elliptical hole are deduced from the general solution, and numerical results are obtained for the distribution of stress round the edges of an elliptical hole in a spruce plank under tension, a square hole in an isotropic tension member and in an isotropic plate under shear, and a triangular hole in an isotropic tension member. The method of solution is an extension of one used previously [Abstr. 2151 (1942)]. L. S. G.

531.252.2 992

**Stress systems in aeolotropic plates. VI.** GREEN, A. E. *Proc. Roy. Soc. A*, **184** (*No.* 998) 289–300 (*Aug.* 21, 1945).—The stress distribution due to hyperbolic notches in an aeolotropic plank under tension or flexure is discussed theoretically when the plank has two directions of symmetry at right angles. Numerical results relating to spruce wood, which is highly aeolotropic, are given, the elastic constants being given numerical values found by experiment. The calculated stresses are used in conjunction with measurements of ultimate strength to determine the kind of failure which might be expected near notches in a spruce plank under tension. L. S. G.

531.252.2 993

**Stress systems in aeolotropic plates. VII.** GREEN, A. E. *Proc. Roy. Soc. A*, **184** (*No.* 998) 301–45 (*Aug.* 21, 1945).—A general method is given for obtaining the stress distributions in isotropic and aeolotropic plates containing a hole, when the boundary values of the displacements are prescribed. Applications are made to an aeolotropic plate with a circular or elliptical hole; and in the case of a circular hole when the boundary conditions at the edge are mixed, i.e. involve both the displacements and the stresses, a set of fundamental stress functions is obtained which are used to investigate stresses due to bolts and knots in stressed planks. Numerical results for spruce are given. Next a solution is given for an aeolotropic plate containing any distribution of circular holes of any size. The method in this case is analogous to one used earlier [Abstr. 316 (1941)] for isotropic plates. The case of two equal circular holes is treated in detail and numerical results are given. L. S. G.

531.252.2 994

**The transverse flexure of perforated isotropic plates.** HOLGATE, S. *Proc. Roy. Soc. A*, **185**, 35–49 (*Jan.* 10, 1946).—The complex variable method [Green, Abstr. 991 (1946)] is used to solve the problem of a large thin plate (containing a hole) bent or twisted by couples at infinity. Known results for circular and elliptic holes are obtained as special cases. Numerical values of the stress couple round the edge of a square hole or a triangular hole, each with rounded corners, are given, and the results are also presented in graphical form. The main practical value of the solutions lies in the determination of the concentration of tangential stress couple on the periphery of the hole. L. S. G.

531.252.2 995

**The transverse flexure of perforated aeolotropic plates.** HOLGATE, S. *Proc. Roy. Soc. A*, **185**, 50–69 (*Jan.* 10, 1946).—The problem of Abstr. 994 (1946) is extended to aeolotropic plates, and applied to the case of a spruce plate, for which numerical results are given. Extension is made to elliptical holes and a solution is given of the problem of a plate bent into the form of a cylinder whose generators are parallel to the major axis of the hole. L. S. G.

531.252.2 : 517.947 *see Abstr.* 945

531.252.3 : 517.947 *see Abstr.* 946

531.258 996

**Non-linear theory of curved elastic sheets.** BROMBERG, E., AND STOKER, J. J. *Quart. Appl. Math.*, **3**, 246–65 (*Oct.*, 1945).—The disadvantage of a linear theory, which neglects bending, is discussed, and a non-linear theory is developed which takes account of certain non-linear terms in the relations for the strains as functions of the displacements. As a preliminary three different specializations of the non-linear plane sheet theory are discussed. The third, the non-linear large deflection theory, is generalized to the case of curved sheets. Expressions are given for the strains in terms of the displacements, and from the integral for the potential energy the Euler varia-

tional equations minimizing this energy are obtained. These together with the boundary conditions are a complete formulation of the problem. The general theory is specialized for the case of a spherical sheet and numerical solutions are given for the flat spherical segment. L. S. G.

531.258 : 517.947 *see Abstr.* 947, 948

531.259.2 997

**On the buckling of a thin-walled circular tube loaded by pure bending. I–II.** BIEZENO, C. B., AND KOCH, J. J. *Proc. Ned. Akad. Wet.*, 43 (*No.* 7) 783–96 *and* (*No.* 8) 923–35 (1940).—The tube is loaded at its ends by two equal and opposite bending moments, $M$. For certain critical values of $\bar{M}$, longitudinal and circumferential waves appear in the cylindrical shape of the tube. These are studied as a problem in the theory of elasticity. The differential equations of the buckling problem are set up and, since these are linear and homogeneous in the displacements, they only admit solutions for special values $M = \mu\bar{M}$. The values of $\mu$ are given by a determinantal equation. The smallest root (the most important) of this equation is found by an iterative method. L. S. G.

531.259.2 998

**The stress distribution in a long circular cylinder when a discontinuous pressure is applied to the curved surface.** TRANTER, C. J., AND CRAGGS, J. W. *Phil. Mag.*, 36, 241–50 (*April*, 1945).—The pressure is assumed to be axially symmetric and static. The stress distribution is obtained by using the complex form of the Fourier integral transform. Numerical results are given for the particular case in which the applied stress is a uniform pressure over half the length of the cylinder the other half being unloaded. L. S. G.

531.3 : 621.93 999

**Basic mechanics of the metal-cutting process.** MERCHANT, M. E. *J. Appl. Mech.*, **12**, *A*257–60 (*Dec.*, 1945).—Discussion. [See Abstr. 575 B (1945)].

531.383 1000

**The spherical gyrocompass.** KOHN, W. *Quart. Appl. Math.*, 3, 87–8 (*April*, 1945).—A study is made of the motion of a gyrocompass, the rotor of which has a spherical ellipsoid of inertia. The general theory of the motion is complicated but in this special case a much simpler treatment is possible. No approximations are necessary. L. S. G.

531.44 : 669.4/.6 *see Abstr.* 1188

## MECHANICAL MEASUREMENTS 531.7

531.7 : 536 1001

**Mechanical and thermal instruments.** EVANS, J. C. *J. Sci. Instrum.*, 23, 26–9 (*Feb.*, 1946).—A description of some of the exhibits at the Physical Society's Exhibition, London, Jan. 1946.

531.717.1 : 621.386.1 1002

**Continuous gauging with X-ray micrometer.** WOODS, R. C., AND FUA, F. *Iron Age*, **156**, 50–1 (*Nov.* 29, 1945).—The thickness of sheet in motion can be gauged with high sensitivity by a device which combines X-rays and electronic elements. It can be applied to measure the wall thickness of long-coated metals; the thickness of the coating and that of the backing plate can be measured independently. M.-V.

531.751 : 519.241 : 677.01 1003

**Some calculations relating to the arrangement of fibres in slivers and rovings.** FOSTER, G. A. R., GREGORY J., AND WOMERSLEY, J. R. *J. Text. Inst., Manchr*, 36, *T*311–23 (*Dec.*, 1945).—[Abstr. 983 B (1946)].

531.767 : 612.7 *see Abstr.* 1180

531.788.7 : 537.561 *see Abstr.* 1090

## MECHANICS OF LIQUIDS 532

532.133 : 621.892 1004

**Viscosity of lubricants under high pressure.** HERSEY, M. D., AND HOPKINS, R. F. *Mech. Engng, N.Y.*, 67, 820–4 (*Dec.*, 1945).—[Abstr. 930 B (1946)].

532.5 : 629.12.037 1005

**The transient performance of propellers and ships during backing and reversal. II.** RÜDENBERG, R. *J. Franklin Inst.*, 240, 347–78 (*Nov.*, 1945).—In continuation of previous work [Abstr. 393 (1946)] it is shown that the transient behaviour of the propeller exhibits the production of a vortex during every rapid change of propeller speed, leading to the development of inertia forces, which add to the inertia forces of propeller and driving machinery in the reversal condition and consume much of the available reversing torque. These transient forces develop a pressure drop in the water behind the blades which may cause cavitation during reversal and lead to collapse of the backing thrust. Conditions for avoiding this phenomenon are discussed. A simple formula or chart can reduce the working conditions of the propeller behind the hull to operation in open water. Contraction of the moving propeller jet varies widely over the ranges of operation and changes to expansion under backing conditions. The coeff. of contraction of the equivalent standing jet probably varies between 0·5 and 1 over the ranges of driving, backing and reversal of the propeller, resulting in distortion of the parabolic shape of the thrust-velocity characteristic. J. S. G. T.

532.511 : 551.511 = 3 *see Abstr.* 1171

532.517.4 : 536.24 1006

**Diffusion in turbulent flow between parallel planes.** JAEGER, J. C. *Quart. Appl. Math.*, 3, 210–17 (*Oct.*, 1945).—The diffusion equation in a turbulent fluid,

$$\partial^2\chi/\partial z^2 + (1 - 2p)z^{-1}\partial\chi/\partial z = \partial\chi/\partial x$$

is solved by means of the Laplace transformation method and a number of results for symmetrical flow are given. It is shown that all the results of a previous paper [Abstr. 2530 (1943)] may be obtained more shortly by this method. The significance of some of the results in problems of heat transfer is indicated. L. S. G.

532.525 : 533.6.011.5 *see Abstr.* 1015

532.525 : 621.1.013 1007

**The discharge of saturated water through nozzles.** SILVER, R. S., AND MITCHELL, J. A. *Trans. N.E. Cst Instn Engrs Shipb.*, 51–72 (1945).—In the discharge of saturated water (i.e. water at a temperature very close to that at which its vapour pressure would be equal to the pressure exerted on the water) through nozzles, the anticipated evaporation does not occur. A quantitative theory of the rate of vapour formation is

required in order to estimate flow conditions and how they are affected by nozzle dimensions. A theory is developed in which it is assumed that a cylindrical stream of liquid emerges from the nozzle, remaining in the superheated metastable state, suggested by Bottomley, without formation of bubbles, with evaporation occurring at its surface. Fair agreement is found between experimental and theoretical values of the discharges from a series of nozzles. Discrepancies, which are significant, are discussed. With the larger nozzles and at higher pressures the metastable state is disturbed so much that the experimental discharges are less than the theoretical values.

J. S. G. T.

532.527 = 3 1008

**On theorems relating to hydrodynamical vortices.** ERTEL, H. *Phys. Z.*, 43, 526–9 (*Dec.*, 1942) *In German.*—The vortex equations are formulated in general terms by means of an exchange relation: $(D_1D_2 - D_2D_1)\psi = N(p, \sigma, \psi)$ where $D_1$ and $D_2$ are certain differential operators, $p$ is the pressure, $\sigma$ the sp. vol. and $\psi$ a field function. Three theorems are then deduced, e.g. if $\psi$ is a conservative property of the particles composing the fluid, we have $D_1\psi = 0$ and the above relation reduces to

$$\frac{d}{dt}\left(\sigma\xi_i\frac{\partial\psi}{\partial x_i}\right) = N(p, \sigma, \psi)$$

The physical interpretation of this equation is given.

L. S. G.

532.542.1 = 4 1009

**Definition and measurement of loss of head in industrial pipes.** FORTIER, A. *Rev. Gén. Élect.*, 54, 313–19 (*Oct.*, 1945) *In French.*—Loss-of-head formulae established for uniform flow are well known and commonly applied to cases of variable or turbulent flow by making use of the average flow through the pipe concerned. Exact formulae are developed analytically for these cases, involving the speed fluctuations in the flow and the variations of speed throughout a given cross-section. Experimental verification and comparison of the different formulae requires particular care in the use of the differential manometer since an accuracy to within 1% is necessary.

E. O. T.

532.61 1010

**The surface tension of molecular solutions.** MCCORMICK, H. *Phil. Mag.*, 36, 288–93 (*April*, 1945).—Apparatus is described for the measurement of surface tension, based on the falling drop method. For accurate measurement the diameter of the dropping surface must be 5 mm, measured accurately to within 0·01 mm; then the surface tension in dyne/cm has the same numerical value as the mass of one drop in milligrams. In the case of a molecular solution the molecular weight of the solute may be found from the increase in the surface tension of the solvent produced by the solute. The results of measurements on a large number of materials are given. L. S. G.

532.696.1 : 536.423.1 *see Abstr.* 1066

532.71 : 541.13 : 539.217 *see Abstr.* 1127, 1128

532.71 : 541.18 *see Abstr.* 1139

## MECHANICS OF GASES 533

533.275 : 551.508.71 = 3 *see Abstr.* 1165

533.343.4 : 551.521.3 *see Abstr.* 1174

533.5 1011

**Oil-sealed spherical joints for high-vacuum application.** THORP, C. E., AND LANDAY, H. L. *Industr. Engng Chem.* (*Analyt. Edit.*) 17, 741–2 (*Nov.*, 1945).

533.5 1012

**A useful seal for dynamic vacuum systems.** D'EUSTACHIO, D. *Rev. Sci. Instrum.*, 16, 377–8 (*Dec.*, 1945).

533.56 1013

**The theory of the mercury-vapour vacuum pump and a new high-speed pump.** ALEXANDER, P. *J. Sci. Instrum.*, 23, 11–16 (*Jan.*, 1946).—Gaede's theory of the operation of mercury vapour pumps took into account the fact that for low streaming velocity of vapour, the net gas transfer was reduced, owing to the vapour not being entirely gas-free; Gaede neglected, however, the increase in collision frequency obtained by increasing the velocity of the vapour, and so concluded on theoretical grounds that high pumping speeds were unattainable. The author's experiments show that the vapour stream past a nozzle remains quite compact for a considerable distance, i.e. Gaede's theory is not wholly true, and in particular Gaede's conclusion as to maximum pumping speeds is incorrect. The author describes pumps based on his extension of Gaede's theory, and having measured volumetric pumping speeds up to 1 400 l/sec at any pressure from $10^{-4}$ to $10^{-2}$ mm mercury.

N. C.

533.6.011 1014

**On rotational gas flows.** VAZSONYI, A. *Quart. Appl. Math.*, 3, 29–37 (*April*, 1945).—The theory of the irrotational motion of a frictionless compressible fluid is not sufficient to cope with some of the present-day problems in aerodynamics, e.g. supersonic phenomena, shock waves; and a study is now made of the motion of a gas under less restricted conditions. The fundamental equations are first set up. These are the continuity equation, the Navier-Stokes equation and the energy equation. Then some vortex theorems for frictionless fluids are given. Adiabatic, steady frictionless flow is next considered and an analysis is made of the flow around an obstacle with shock waves.

L. S. G.

533.6.011.5 : 532.525 1015

**Nozzles for supersonic flow without shock fronts.** SHAPIRO, A. H. *J. Appl. Mech.*, 12, *A*260–2 (*Dec.*, 1945).—Discussion. [See Abstr. 2138 (1944)].

533.6.08 1016

**The behavior of a hot-wire anemometer subjected to a periodic velocity.** MARTINELLI, R. C., AND RANDALL, R. D. *Trans. Amer. Soc. Mech. Engrs*, 68, 75–9 (*Jan.*, 1946).—A method is given for the rapid graphical prediction of the response of the constant-current hot-wire anemometer to a periodic velocity. The suitability of the hot-wire anemometer for any particular application can then be readily determined. Several illustrative examples are provided.

## ACOUSTICS . VIBRATIONS 534

534.121.2 : 621.396.611.4 : 517.947 *see Abstr.* 949

534.13 1017

**On the vibrations of the rotating ring.** CARRIER, G. F. *Quart. Appl. Math.*, **3**, 235–45 (*Oct.*, 1945).—The dynamical equations are set up and an analysis based on these solves the following problems. For the unconstrained ring the frequencies of the small bending vibrations are determined. For the partially constrained ring it is shown that the free vibrations differ essentially in character from those of the free ring. A group of natural modes occur which are characterized by linear combinations of trigonometrical functions. The forced vibrations of the free and supported rings are also analysed and in the case of an elastically supported ring an interesting eigenvalue problem is discussed. L. S. G.

534.22 1018

**Sound velocity and inter-molecular action in liquids.** PARSHAD, R. *Indian J. Phys.*, **19**, 47–62 (*April*, 1945).—An attempt is made to explain Parthasarathy's [Abstr. 1696 (1938)] empirical rules relating sound velocity and constitution of pure organic liquids, on the basis of the theory of intermolecular attractive forces. It is shown how cohesion and sound velocity depend upon the molecular structure of liquids, and some further rules, especially between diamagnetic susceptibility and velocity, are introduced. The effect of association on compressibility and factors giving rise to cohesion and viscosity are also discussed.

534.22 : 534.321.9 = 3 *see Abstr.* 1021

534.22 : 541.6 1019

**Relationships between the velocity of sound and other physical properties of liquids.** LAGEMANN, R. T., AND DUNBAR, W. S. *J. Phys. Chem.*, **49**, 428–36 (*Sept.*, 1945).—A new physical constant, $V = Mv^{1/3}/d$, involving the velocity of sound in liquids, is found to be a linear function of the parachor, mole refraction, Souders' viscosity constant, molecular magnetic rotation, critical volume, and van der Waals' $b$ for members of 4 homologous series. The constants of the equations are evaluated. This implies that all the above properties are linear among themselves for homologous series and to a good approximation the linearity may be applied to all compounds. The critical temperatures and b.p.s of homologous series of unassociated compounds $\propto \log V$. Lists of atomic increments and the accompanying constitutive values are compiled for several of the properties, including molecular sound velocity, and lists of bond increments are reported and their relationships noted.

534.23/.24 1020

**On the theory of the reflection of sound by porous media.** KORRINGA, J., KRONIG, R., AND SMIT, A. *Physica, 's Grav.*, **11**, 209–30 (*Dec.*, 1945).—[See Abstr. 1348 (1945)]. The porous medium is formed by a large number of identical rigid spheres with infinite heat capacity and thermal conductivity, which are arranged in a cubic lattice. The aerodynamic equations of motion and the boundary conditions of the problem are formulated, and the propagation of a plane sound wave along one of the cubic axes is treated in the case when the cubic lattice fills all space. Such a wave can be described by means of a complex index of refraction $N$, which is a function of the frequency, the lattice constant, the radius of the spheres and the frictional and thermal properties of the air. The acoustical impedance $Z_\infty$ of an infinitely thick layer of the lattice, bounded by a plane interface against free air, which determines the reflecting properties of the layer, is not expressible in terms of the index of refraction alone, but is given by another function. The acoustical impedance $Z_s$ for a layer of thickness $s$ on a perfectly rigid backing from $Z_\infty$ is obtained. A comparison between theory and experiment is made, the results being shown graphically.

534.321.9 : 534.22 = 3 1021

**On measurement of ultrasonic velocity in gases.** BÖMMEL, H. *Helv. Phys. Acta*, **16** (*No.* 5), 423–5 (1943) *In German.*—With h.f. the usual sound interferometer method is inaccurate, and that of Debye and Sears, in which the sound waves act by diffraction on the light waves, was modified by employing 2 frequencies at the same time, enabling dispersion to be observed if present. In tests with $CO_2$, $O_2$, $N_2$, A and air no dispersion was observed in the frequency intervals between the fundamental and 3rd or fundamental and 5th harmonic of a quartz crystal with a prime of 951 kc/s. The known dispersion region in $CO_2$ was displaced by the application of pressure and addition of another gas, and on testing in the interval 951–2 853 kc/s a change of velocity of 2% was measured with an accuracy of 2 in a thousand. G. E. A.

534.511.1 = 4 1022

**Audition of a concert, of distant sounds, and the scintillation of stars.** PICCARD, A. *Helv. Phys. Acta*, **16** (*No.* 5) 425–7 (1943) *In French.*—Various examples of sound interference in concert hall and church are cited in which, using one ear, surfaces of silence may be detected, and also changes in the quality of the sound heard. The variation in the loudness of the hum of a one-engined aeroplane high overhead or of a distant church-bell at night is due to inhomogeneities in the air which cause changes in the speed and direction of the sound waves. Interference of light waves in their passage through the air is the cause of the twinkling of the stars. G. E. A.

## OPTICS . RADIATION . SPECTRA 535

535.14 : 535.338.334 = 4 1023

**Radiation damping on the quantum theory.** STUECKELBERG, E. C. G. *Helv. Phys. Acta*, **16** (*No.* 5) 427–8 (1943) *In French.*—If Dirac's method of the invariant subtraction of divergent terms [Abstr. 3660 (1938)] is applied to the case of the effective cross-section for the diffusion of photons, taking damping into account, a non-contradictory theory is obtained of which the formalism is that recently proposed by Heisenberg [Abstr. 2109 (1944)]. The factor $(1 + \delta^2)^{-1}$, which allows for damping on the classical theory, becomes $(\sin\delta)^2/\delta^2$. In the case of a particle of mass $m$ in a scalar field of frequency $\mu$, the Klein–Nishina equation for the effective cross-section becomes

$$Q(\alpha) = Q(0)\left[1 - 4\alpha + \left(\frac{24}{5} - \frac{2}{27}\frac{\varepsilon^2}{4\pi}\right)\alpha^2 - \cdots\right]$$

For $\mu \gg m$, $\delta = \varepsilon^2/8\pi$. Where $\varepsilon^2/8\pi \gg 1$,

$$Q(\alpha) \to 4\pi/m\mu.$$

The theory also applies to the width of a spectral line of frequency $\mu_0$. The classical factor $\gamma^2/[(\mu-\mu_0)^2+\gamma^2]$ then becomes $(\sin\gamma)^2/(\mu_0-\mu)^2$ on the quantum theory. A. J. M.

535.215 : 621.383 1024

**Characteristics of the Ag-Cs and Sb-Cs photoelectric surfaces.** LEWIN, G. *Trans. Electrochem. Soc.*, 87, (*Prepr.* 22) 8 *pp.* (1945).—Characteristics of the S1 (Ag-Cs) and S4 (Sb-Cs) photo-electric surfaces are discussed. Procedures followed in producing these surfaces are outlined. Data on current output, spectral sensitivity, dark current, and fatigue are given. Theoretical considerations of the probable electrochemical action responsible for sensitivity of the S1 surface in the red region are presented.

535.225 : 521.91 = 3 1025

**On the theory of the Doppler effect and aberration of light.** RÜCHARDT, E. *Phys. Z.*, 43, 525–6 (*Dec.*, 1942) *In German.*—A derivation of formulae is presented which is much simpler than that usually given; it avoids the use of a Lorentz transformation. L. S. G.

535.231.4 : 621.385.032.22 1026

**Effect of surface finish and wall thickness on the operating temperature of graphite radio-tube anodes.** WINTER, L. L., AND MACPHERSON, H. G. *Proc. Inst. Radio Engrs, N.Y.*, 33, 834–7 (*Dec.*, 1945).—[Abstr. 852 B (1946)].

535.241.431 : 628.9.033 = 4 1027

**Calculation of the illumination from linear light sources and comparative measurements on fluorescent tubes, using rectifier photocell illuminometers.** COHU, M. *Rev. Gén. Élect.*, 52, 92–6 (*March*, 1943) *In French.*—Derives the formula for the illumination from a line source and compares the values thus calculated with those found in practice using (*a*) a Macbeth visual illuminometer, (*b*) photoelectric illumination photometers. J. W. T. W.

535.242.088.21 = 4 1028

**Asymmetry of visual perception.** TERRIEN, J. *Rev. Opt. (Théor. Instrum.)*, 22, 1–8 (*Jan.-March*, 1943) *In French.*—Examines the magnitude of the personal error in visually matching illuminated surfaces, and discusses the effect this has upon the magnitude of photometric errors. Methods for the elimination of the error are given. A. H.

535.247.4 1029

**New procedure to measure accurately illumination at large angles of incidence with a barrier-layer cell.** GOODBAR, I. *Illum. Engng, N.Y.*, 11, 830–5 (*Nov.*, 1945).—Describes a mechanical device for giving the correction factor to be applied to the readings of a particular photoelectric illuminometer on account of the obliquity of the incident light. The device deals with the light from a single source only. J. W. T. W.

535.247.4 : 535.651 *see Abstr.* 1048

535.247.4 = 3 1030

**Precision photometry with a caesium photocell and compensating filter.** KÖNIG, H. *Helv. Phys. Acta*, 16 (*No.* 5) 421–2 (1943) *In German.*—Describes a physical photometer consisting of a caesium vacuum photocell and a correction filter made up of a combination of 3 Schott glasses in appropriate thicknesses. J. W. T. W.

535.322.4 1031

**A simple refractoscope for liquids.** WILLARD, G. W. *Rev. Sci. Instrum.*, 16, 340–2 (*Dec.*, 1945).—A comparison instrument designed especially for use in mixing and testing the binary, quartz-matching, immersion liquids now widely used in quartz inspection and orientation instruments. The optical system comprises only a slit and a Z-cut quartz prism immersed in the liquid, and a lens contacting the liquid surface. By observing the slit both through, and to the sides of, the prism it is possible to detect a $\Delta N = 0{\cdot}001$ mismatch between the liquid index and the desired quartz index. Further, without additional scales or other means, the degree of mismatch may be closely estimated, by comparison with the $\Delta N = 0{\cdot}01$ birefringence in the quartz prism itself.

535.322.4 1032

**A refractometer.** HERNDON, T. C. *Rev. Sci. Instrum.*, 16, 379–80 (*Dec.*, 1945).

535.33 : 537.568 *see Abstr.* 1092

535.33.072-15 : 545.82 = 3 1033

**Recording infra-red spectrometer for chemical analytical purposes.** GANZ, E. *Helv. Phys. Acta*, 18 (*No.* 7) 551–8 (1945) *In German.*—Describes a recording spectrograph covering the range 0·8 to 24 $\mu$ by means of 4 prisms. The source of radiation is a rod of silicon carbide taking 200–250 W at 30 V and running at a temperature of about 1 150°K. The best conditions as regards relation of exit slit width and wavelength are secured automatically throughout the spectral range covered. Details of the performance of the instrument are given. J. W. T. W.

535.331 1034

**The isotope effect in the spectrum of Nd I.** KLINKENBERG, P. F. A. *Physica, 's Grav.*, 11, 327–38 (*Dec.*, 1945).—By studying the spectrum of Nd I with high resolving power apparatus a number of weaker lines are found to be of complex nature. This complexity is interpreted as an isotopic displacement. While the frequency intervals between the components belonging to $^{142}$Nd, $^{144}$Nd, $^{146}$Nd and $^{148}$Nd are equal within the limits of the measuring accuracy, the interval $^{148}$Nd—$^{150}$Nd that could be determined in 4 different electron transitions has an average value which is 1·7 times greater. A similar anomaly is known only in the spectrum of Sm. A discussion is given of the connection between the observed structure and the possible line classification in a system of spectral terms.

535.331 : 539.153 *see Abstr.* 1112

535.333 : 539.132 *see Abstr.* 1106

535.338.1 : 539.15 *see Abstr.* 1107

535.338.334 : 535.14 = 4 *see Abstr.* 1023

535.338.4 1035

**New Green band system of $N_2$ and conditions of excitation.** TAWDE, N. R., AND GAYDON, A. G. *Nature, Lond.*, 157, 136 (*Feb.* 2, 1946).—[See Abstr. 880 (1944)].

535.338.4 : 539.155.2 = 3 1036

**The band spectrum of tellurium dichloride with heavy chlorine.** WEHRLI, M., AND SPINNLER, W. *Helv. Phys. Acta*, 17 (*No.* 4) 240–2 (1944) *In German.*—The results are given of experimental measurements of the isotope separation, $\Delta\lambda$, between $TeCl_2^{37}$ and $TeCl_2^{35}$ and the related edges, $\nu$, of $TeCl_2^{35}$, where $\nu$ is the wave number. L. S. G.

535.341 : 535.434 : 541.18.041.2 = 4 1037

**Absorptiometry of suspensions and the phenomenon of flocculation.** DOGNON, A. *Rev. Opt.* (*Théor. Instrum.*) 22, 9–19 (*Jan.–March*, 1943) *In French.*—Surveys the theory of the optics of turbid media, particularly variation of optical density with dimensions of particles and with distance of observing instrument. The variation of optical density with wavelength is also examined. The treatment developed is applied to the question of the opacity of colloidal solutions tending towards flocculation. A. H.

535.341 : 578.087.8 1038

**A single cell photo-electric absorptiometer in which the intensity of light source and characteristics of the photo-cell may change without causing error in estimation.** PETERSON, J. M. *J. Physiol.*, 103, *Proc.* (*June*) 15–16 (*Sept.*, 1944).—Light is reflected from a single source through two identical apertures, and the beams of light are bent by a lens to fall on the same area of the photo-cell. A semi-circular rotating disc alternately interrupts the two paths of light while maintaining the effective aperture constant. One of two annular spectroscopically neutral wedges has a marginal scale. The procedure is described. C. J. G.

535.343.32 : 535.372 1039

**On the intensities and the multipole character in the spectra of the rare earth ions.** BROER, L. J. F., GORTER, C. J., AND HOOGSCHAGEN, J. *Physica, 's Grav.*, 11, 231–50 (*Dec.*, 1945).—The various mechanisms are discussed by which the forbidden transitions in the incomplete 4*f*-shell can occur. This discussion is based on a paper by Van Vleck [Abstr. 1889 (1937)], but the estimated intensities do not in all respects agree with those of that paper. It is shown that the electric quadrupole radiation is far too weak to account for the observed intensities, whereas the magnetic dipole radiation only under certain circumstances will be able to do so. Some instances of magnetic dipole radiation are explained and others are predicted. The electric dipole radiation may account for intensities of the required order, except for two strong bands in $Pr^{+++}$ and $Tm^{+++}$, which are difficult to explain on the basis of the discussed mechanisms.

535.37 : 538.222 *see Abstr.* 1102

535.372 1040

**On phosphorescence vibration spectra of polyatomic molecules.** REDLICH, O., AND HOLT, E. K. *J. Amer. Chem. Soc.*, 67, 1228–9 (*July*, 1945).—The recent work of Lewis and Kasha [Abstr. 1425 (1945)] is amplified on the basis of the Franck-Condon principle. Complete interpretation of phosphorescence vibration spectra requires the analysis of vibration spectra and knowledge of the parameters of the phosphorescent state. An equation is given for the quantum number of the *k*th vibration in terms of the vector of the normal co-ordinates and the vector representing distortion of the phosphorescent molecule. The method is applied to benzene, *trans*-dibromoethylene, naphthalene, and β-chloronaphthalene. W. R. A.

535.372 : 535.343.32 *see Abstr.* 1039

535.39.08 = 4 1041

**Graphical method for the rapid determination of reflection factors of compound plates.** PERROT, M. *Rev. Opt.* (*Théor. Instrum.*) 22, 20–8 (*Jan.–March*, 1943) *In French.*—A theoretical treatment is given of the case of a thin metallic layer deposited on the surface of a slightly prismatic transparent support. The relations thus obtained form the basis of a graphical method which permits of the rapid determination of the various optical quantities involved, including the variation with thickness of the reflection coefficient of the metallic layer. The results are applied to the case of several metals on glass. A. H.

535.392 1042

**Polynomial representation of reflectance curves.** MOON, P., AND SPENCER, D. E. *J. Opt. Soc. Amer.*, 35, 597–600 (*Sept.*, 1945).—Spectral reflectance and absorption curves are found to fall mainly into 6 comparatively simple types, to which polynomial expressions can be fitted. The specification and integration of the curves is thereby simplified, and tables of factors are included for this purpose.

535.41 1043

**New contributions to interferometry. VI. White light Fabry–Perot fringes.** TOLANSKY, S. *Phil. Mag.*, 36, 236–41 (*April*, 1945).—The Fabry–Perot fringes are very easy to produce experimentally, only low resolving power instruments being needed. The fringes appear as a large number of strongly curved narrow fringes extending across the whole spectrum. Photographs of these are given and their relationship to the fringes of Part V [Abstr. 1044 (1946)] is discussed. They have little practical application. L. S. G.

535.417 : 620.179.6 1044

**New contributions to interferometry. V. New multiple beam white light interference fringes and their applications.** TOLANSKY, S. *Phil. Mag.*, 36, 225–36 (*April*, 1945).—[See Abstr. 1798 (1944)]. The theory and properties of the fringes are discussed in detail and some applications to precision interferometry are considered. It is emphasized that the high power and wide application of the fringes depend upon the employment of many multiple beams. A precision, and variety in the range of application, is achieved which probably surpasses that shown by any other existing low-order interference fringes in the whole of optics. Examples are given of an application of the fringes to the study of surface contours and the detection and measurement of small angles. Surface defects may be measured even if only of the order of $\lambda/200$. New topographical features are revealed on the cleavage faces of mica crystals [see Abstr. 610 (1946)]. In the measurement of small surface angles the resolution available is 100 times better than that of the Rayleigh limit. L. S. G.

535.42 : 522.6 1045

**The theory of the Foucault test.** GASCOIGNE, S. C. B. *Mon. Not. Roy. Astr. Soc.*, 104 (*No.* 6) 326–34 (1944).—A diffraction theory for the Foucault

knife-edge test is given, a closed expression being obtained for the variation of light-intensity over a mirror with arbitrary error when it is tested with a knife-edge. The geometrical explanation of the test is derived as the limit when $\lambda \to 0$, and examples are given of several commonly occurring errors. In particular, it is shown that an edge turned by $\frac{1}{2}n\lambda$ will give rise to $n$ well-defined rings.

535.42 : 621.396.671 = 4 1046

**Quasi-optical links; ellipsoidal models and space aerials, with experimental results.** DREYFUS-GRAF, J. *Helv. Phys. Acta*, **17** (*No.* 4) 245–50 (1944) *In French.*—[Abstr. 890 B (1946)].

535.434 : 541.18.041.2 : 535.341 = 4 *see Abstr.* 1037

535.566.2 = 3 1047

**On the influence of the molecular electrostatic field of a solvent on optical rotation.** GUTZWILLER, N. *Helv. Phys. Acta*, **18** (*No.* 7) 497–526 (1945) *In German.*—According to theory the rotivity, defined as the specific rotatory power divided by $(n^2 + 2)$, where $n$ is the index of refraction for light of the frequency in question, is a linear function of the field acting on the solute molecules. The theoretical relation can be tested either by using different solvents, since the field depends on the permittivity, or by using mixtures of a polar and a non-polar solvent in various proportions. The substance chiefly investigated was diethyl tartrate, about a dozen solvents or solvent mixtures and several wavelengths being used. On the whole the theoretical relation was found to be correct. A. J. C. W.

535.651 : 535.247.4 1048

**A direct-reading photoelectric colorimeter.** BARNES, B. T. *Rev. Sci. Instrum.*, **16**, 337–9 (*Dec.*, 1945).—A special current balance is used with photo-cell filter combinations whose spectral sensitivities are nearly proportional to the I.C.I. $\bar{x}$, $\bar{y}$, and $\bar{z}$ functions. Approximate colour co-ordinate values are indicated directly on the dials of this instrument. This makes routine colorimetry more convenient and accurate than with previous equipment [Abstr. 4536 (1939)]. The instrument can also be used as a direct-reading photometer.

535.653.32 = 3 1049

**On an objective colorimeter.** KÖNIG, H., AND MÄDER, F. *Helv. Phys. Acta*, **16** (*No.* 5) 419–21 (1943) *In German.*—Describes a colorimeter in which measurements are made with a potassium vacuum photocell, using the Ives (template) method of compensating the sensitivity curve of the cell. J. W. T. W.

535.661.3 1050

**Unusual colours produced by uranium in glasses.** COLBERT, W., AND KREIDL, N. J. *J. Opt. Soc. Amer.*, **35**, 731–5 (*Nov.*, 1945).—When U is introduced into ordinary soda lime silicate glasses under oxidizing conditions the familiar fluorescent yellowish glass is obtained. However, non-fluorescent glasses of various colours, yellow, red, brown and green can be obtained by introducing U into other types of glass, either under oxidizing or under strongly reducing conditions. The spectral transmission curves of a number of such glasses (including a red which is insensitive to temperature) are given. J. W. T. W.

535.7 : 612.843.611 *see Abstr.* 1182

535.733.1 1051

**Note on MacAdam's determination of chromaticity sensibilities.** SINDEN, R. H. *J. Opt. Soc. Amer.*, **35**, 737–41 (*Nov.*, 1945).—In MacAdam's determination of chromaticity sensitivities [see Abstr. 2329 (1942)], filters were used instead of spectral colours to produce the desired illuminants. The results obtained were therefore not independent of selective absorption in the optical media of the observer's eye. The author shows that the results obtained by one of the two observers were probably affected by smaller than usual macular pigmentation, and that MacAdam's data may therefore need modification. J. W. T. W.

535.733.1 1052

**On the MacAdam ellipses.** WUNDHEILER, A. W. *J. Opt. Soc. Amer.*, **35**, 767–71 (*Dec.*, 1945).—[See Abstr. 2329 (1942), 2333 (1943)].

535.733.1 1053

**Tritanopia and colour vision.** PIÉRON, H. *Nature, Lond.*, **157**, 106 (*Jan.* 26, 1946).

535.755 1054

**Two criteria for the selection of colour vision test plates.** GREEN, E. L., AND SLOAN, L. L. *J. Opt. Soc. Amer.*, **35**, 723–30 (*Nov.*, 1945).—Pseudo-isochromatic charts (e.g. the Ishihara plates) are used for rough discrimination of colour defectives. The requirements which should be met by such charts are described and a system for grading sets of test plates in order of merit is proposed. J. W. T. W.

535.755 1055

**An improved screening test for red-green color deficiency composed of available pseudo-isochromatic plates.** SLOAN, L. L. *J. Opt. Soc. Amer.*, **35**, 761–6 (*Dec.*, 1945).

535.8 1056

**The British optical industry in the war.** MARTIN, T. *J. Sci. Instrum.*, **23**, 21–6 (*Feb.*, 1946).—Describes design and production problems. Binoculars, artillery dial-sights, theodolites, tank periscopes and microscopes all had to be designed for different conditions of service. Blooming of surfaces found increasing use; the field of view of all instruments was enlarged where possible; a totally enclosed construction was used for some tropical instruments; a lubricant was found suitable for use between 60°c and −50°c. New glasses have been developed, and improved cement for a large temperature range. Plastics have not yet been found to replace optical glass. N. C.

535.8 1057

**Optical and allied instruments.** HOUGHTON, J. L. *J. Sci. Instrum.*, **23**, 29–31 (*Feb.*, 1946).—Describes a number of the optical instruments shown at the Physical Society exhibition, Jan., 1946. These include apparatus for measuring light of brief duration, a portable photometer for measuring brightness distributions, a polar nephelometer, certain high-speed cameras, stroboscopic flash lamps for studying machinery in motion and the new brief-duration high-intensity discharge lamp. Apparatus for making aspherical surfaces and a device for comparing two spherical surfaces of nearly the same radius are mentioned. J. W. T. W.

535.8 : 771.351 = 4 *see Abstr.* 1189

535.825 : 621.365 1058

**A high-temperature furnace for use under the microscope.** LAMBETH, A. J. *Aust. J. Sci.*, **7**, 118–20 (*Feb.*, 1945).—[Abstr. 839 B (1946)].

535.88 = 4 1059

**Optical effect of the glass bulb of the lamp in a projector.** GODFERT, A. M. *Bull. Soc. Franç. Élect.*, **5**, 293–7 (*Oct.*, 1945) *In French.*—Gives first a theoretical treatment of the effect of the lamp bulb on the light reflected from a projector mirror. Some experimental results are also shown. The loss of light from the filament due to bulb reflections is about 8–9%. The loss of light reflected from the mirror, due to the bulb acting as a very imperfect diverging lens, is about 25% for a tubular bulb and 32% for a spherical bulb. J. W. T. W.

## HEAT . THERMODYNAMICS 536

536 : 531.7 *see Abstr.* 1001

536.2 1060

**On the problem of heat conduction in a semi-infinite radiating wire.** LOWAN, A. N. *Quart. Appl. Math.*, **3**, 84–7 (*April*, 1945).—A Laplace transform method is used to solve the problem when there is an arbitrary initial temperature distribution and when the boundary temperature is a prescribed function of time. L. S. G.

536.212.3 1061

**Heat conductivity of glass at 1·3°K.** KEESOM, P. H. *Physica, 's Grav.*, **11**, 339–42 (*Dec.*, 1945).—The heat conductivity of thuringian glass at 1·3°K is $8\times10^{-5}$ cal/cm.deg.sec.

536.24 1062

**Some simplified heat transfer data.** FISHENDEN, M., AND SAUNDERS, O. A. *J. Inst. Fuel*, **19**, 62–74 (*Dec.*, 1945).—Actual heat transfer coefficients, which can be read off directly from curves, have been worked out for liquid and gaseous flow. The examples, however, are prefaced by a brief outline of the more comprehensive methods of correlation upon which they are largely based, on the use of dimensionless numbers or groups, and of the complex nature of heat transmission. Radiation and convection coefficients for gases are examined separately, and their relative values compared. The coefficients have been worked out for air, but they are applicable to nitrogen, oxygen and carbon monoxide for the same mass flow; they can also be used for flue gases with an error usually less than 10%, especially if carbon dioxide is the main product. H. H. HO.

536.24 1063

**Special problems of heat transfer through walls.** LEVY, F. L. *Mod. Refrig.*, **49**, 7–9, 12 (*Jan.*, 1946).—Problems arising in calculating the heat transfer through walls which vary in thickness and in thermal conductivity from point to point are discussed. The cases of transfer through the lagging between an external spherical shell and an internal cube and of transfer through walls in which structural materials form channels through the lagging are considered. L. J. C. C.

536.24 : 532.517.4 *see Abstr.* 1006

536.24 : 662.61 1064

**Total, recoverable and returnable heat in combustion gases.** ROSIN, P. O. *J. Inst. Fuel*, **19**, 53–61 (*Dec.*, 1945).—Statistical relations between the net calorific value, the air requirements, and the combustion gas volume, are dealt with. It is next shown how the heat content of combustion and waste gases at any given temperature may be read from an *I-t* diagram. Finally, the calculation of the total, recoverable or returnable heat in waste gases from the values of the combustion gas volume and its heat content is explained. The paper contains 14 tables and a diagrammatic summary. H. H. HO.

536.423 : 539.217.3 : 677 = 3 1065

**On the drying of textiles.** HONEGGER, E., AND BELLENOT, C. *Schweiz. Bauztg*, **125**, 205–9 (*April* 28, 1945) *In German.*—[Abstr. 982 B (1946)].

536.423 : 541.183.56 *see Abstr.* 1143

536.423.1 : 532.696.1 1066

**Factors affecting boiling in a liquid.** LARSON, R. F. *Industr. Engng Chem.*, **37**, 1004–9 (*Oct.*, 1945).—The phenomena of liquid superheat and of nucleate and film boiling in connection with heat transfer are reviewed. On the basis of wettability or interfacial free adhesion energy, a theory for the solid ebullator is evolved. An apparatus to test the theory is described, and various solids are tested for the ebullition property.

536.423.1 : 536.717 1067

**Occurrence of metastable states of liquid and vapour.** LARSON, R. F. *Industr. Engng Chem.*, **37**, 1010–16 (*Oct.*, 1945).—A thermodynamic theory is advanced for the requirement and mechanism of bubble formation in a heated liquid. Trial calculations using estimated thermodynamic properties of superheated water indicate that the nucleus bubble in the transformation state consists of a single molecule. The theory is extended to condensing water vapour with similar results. The literature is reviewed for supporting evidence. The similarity between the supposed action of the ebullator and of a catalyst is pointed out.

536.423.1 = 4 1068

**Boiling point and altitude.** JAQUEROD, A. *Helv. Phys. Acta*, **17** (*No.* 4) 238–40 (1944) *In French.*—Graphs are given showing the variation in the cases of water and chlorobenzene. The graphs are straight lines and for water two lines are given, one for winter and one for summer. L. S. G.

536.52 : 662.92 1069

**Industrial use of radiation pyrometers under non-blackbody conditions.** HARRISON, T. R. *J. Opt. Soc. Amer.*, **35**, 708–23 (*Nov.*, 1945).—The principles of non-blackbody radiation and of the application of emittance corrections is discussed for various industrial conditions. Beside the commonly treated case of radiation from a non-blackbody in the open, others discussed are radiation from a heated object surrounded by walls at a higher or lower temperature, radiation from an object viewed through flame, smoke, and furnace gases, and radiation from glass. A table and curves are given for obtaining emittance corrections applicable for a radiation pyrometer having a Pyrex glass lens and another table and curves are given for a radiation pyrometer with fused silica lens. The use of an optical pyrometer as a "checking instrument" is discussed, and a table and curves are

given for emittance corrections where $\lambda = 0{\cdot}65\,\mu$. Comparisons are drawn between the readings of the optical pyrometer and radiation pyrometers having the two types of lens, for the condition $e_\lambda = e_t$. For certain cases data and procedures are given by means of which emittance corrections are obtainable. For other cases, only the underlying principles are discussed. A bibliography is given.

536.54 : 621.9.014 1070

**Measurements of temperatures in metal cutting.** SCHMIDT, A. O., BOSTON, O. W., AND GILBERT, W. W. *Trans. Amer. Soc. Mech. Engrs*, **68**, 47–9 (*Jan.*, 1946).—[Abstr. 932 B (1946)].

536.58 1071

**Design for constant-temperature tanks.** CAMPBELL, W. A., AND PRESLEY, J. T. *Phytopathology*, **35**, 213–16 (*March*, 1945).—The construction of 6 redwood tanks for the study of the relation of soil temperatures to infection by soil fungi is described and illustrated. Four of them were electrically heated and thermostatically controlled to give temperatures above that of the water supply (approx. 70°F). The other 2 were cooled by individual refrigeration coils to provide temperatures below 70°F. The temperatures in both types of tank did not fluctuate more than 2° from the desired temperature. C. J. G.

536.587 : 621.316.74 1072

**A highly simplified thermionic control of temperature.** WALLACE, R. H., AND BUSHNELL, R. J. *Plant Physiol.*, **16**, 647–50 (*July*, 1941).—[Abstr. 780 B (1946)].

536.621.1 : 541.115 1073

**An improved apparatus for measuring heats of reaction.** YORKE, S. G. *Chem. and Ind.*, 17–18 (*Jan.* 12, 1946).

536.717 : 536.423.1 *see Abstr.* 1067

536.75 1074

**Entropy and irreversible processes.** EHRENBERG, W. *Phil. Mag.*, **36**, 250–5 (*April*, 1945).—A reply to criticism [Abstr. 397 (1944)] of a previous paper [Abstr. 2193 (1943)]. Certain differential equations, appearing in this paper, are discussed more fully. The complete solution is obtained and this leads substantially to the same result as the particular solution given in the earlier paper. The author justifies his method of approach. L. S. G.

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

537.122 : 538.311 : 539.154.3 = 4 *see Abstr.* 1113

537.22 1075

**The basic mechanisms of static electrification.** LOEB, L. B. *Science*, **102**, 573–6 (*Dec.* 7, 1945).—An examination of the literature shows that the theoretical interpretations put forward to explain static phenomena are frequently inadequate. Five basic mechanisms are discussed, namely electrolytic effects, contact potential mechanisms, spray electrification, friction or tribo phenomena, and the segregation of ions and electrons in gases and flames. It is likely that these basic mechanisms operate together in any particular case, but their separate consideration should help to clarify past results and to guide future work. E. H. D.

537.226.2.08 1076

**Cell for determination of dielectric properties of liquids.** BERBERICH, L. J. *Industr. Engng Chem.* (*Analyt. Edit.*) **17**, 582–4 (*Sept.*, 1945).

537.228.1 = 3 1077

**The inverse piezo-effect of Rochelle-dielectric [seignette-elektrischen] crystals $KH_2PO_4$.** VON ARX, A., AND BANTLE, W. *Helv. Phys. Acta*, **17** (*No.* 4) 298–318 (1944) *In German.*—The effect is studied in the temperature region 100°K–300°K, the Curie point being at $\Theta = 122{\cdot}9$°K. The relation between the electric field and the deformation is investigated in the region $T > \Theta$, and in the Curie region ($T < \Theta$) piezo-electric hysteresis occurs. Several hysteresis curves are given. The thermal linear expansion coefficient is $2{\cdot}2 \times 10^{-5}$ for $T > \Theta$. In the Curie region the thermal deformation is anomalous. L. S. G.

537.228.5 : 523.873 *see Abstr.* 974

537.291 : 538.691 : 621.385 1078

**Dynamics of electron beams. Applications of Hamiltonian dynamics to electronic problems.** GABOR, D. *Proc. Inst. Radio Engrs, N.Y.*, **33**, 792–805 (*Nov.*, 1945).—[Abstr. 850 B (1946)].

537.311.1 : 621.3.014.1 : 621.385 1079

**Fluctuations of electric current.** BELL, D. A. *J. Instn Elect. Engrs, Pt III*, **93**, 37–44 (*Jan.*, 1946).—[Abstr. 851 B (1946)].

537.523.2 1080

**Production of photons in a Townsend gap in air, nitrogen and argon.** FISHER, L. H. *Phys. Rev.*, **68**, 279 (*Dec.* 1 *and* 15, 1945).—[See Abstr. 1350 (1945)].

537.523.4 : 545.823 1081

**The constancy of spectral line excitation in quantitative spectrographic analysis.** JONES, F. L. *J. Soc. Chem. Ind.*, **64**, 317–22 (*Dec.*, 1945).—The electrophysics of the type of spark discharge usually employed in quantitative spectrographic analysis is investigated, and the way in which various parameters affect the excitation process is examined. From this the conditions necessary for stability of excitation are shown to be dependent upon the constancy of certain electrical parameters, the breakdown potential of the gap, initial spark current, and duration and intensity of the arc. In order to obtain the constancy of these parameters the following factors should be specified: (*a*) gap geometry and use of an approximately uniform field; (*b*) circuit constants; (*c*) breakdown potential of the gap; and (*d*) maximum e.m.f. applied to the gap, and, if necessary, the control of the arc current by a series resistance. M.-V.

537.525.5 : 621.314.651 = 4 1082

**Measurement of non-ionized vapour density and its variations in a mercury-arc rectifier.** HERRENG, P., AND BRAUNT, C. *Rev. Gén. Élect.*, **54**, 305–9 (*Oct.*, 1945) *In French.*—[Abstr. 745 B (1946)].

537.525.5 : 621.385.18 1083

**Stability of the low pressure mercury arc as a function of area at the cathode pool.** LUFCY, C. W., AND COPELAND, P. L. *J. Appl. Phys.*, **16**, 740–4 (*Nov.*, 1945).—[Abstr. 857 B (1946)].

537.531 1084

**X-ray line absorption in the *M*-series for 62-Sm.** RULE, K. C. *Phys. Rev.*, **68**, 246–9 (*Dec.* 1 *and* 15,

1945).—The $M_{IV}$ and $M_V$ absorption edges for 62-Sm were studied by use of evaporated films of $Sm_2O_3$ and $SmCl_3$. In view of data in the literature on *M*-absorption of the rare earths 70-Yb and 68-Er, it seemed possible that absorption lines would be found corresponding to transitions in which electrons from the *M*-shell are lifted to the inner $N_{VII}$ and $N_{VI}$ levels. When thin absorption films were employed, the entire absorption had the appearance of lines, but thick films revealed the definite edge-like character of the absorption. The $M_{IV}$ and $M_V$ edges are very similar and are both complex, 4 edges being distinguished in each case. In both cases the first pair of edges is separated from the latter pair by a minimum, which may correspond to transitions in which the electrons are lifted to the $N_{VII}$ and $N_{VI}$ levels.

537.531 : 621.386 : 615.84 1085

**Symposium on X-rays.** *Elect. Engng, N.Y.*, **64**, 423–47 (*Dec.*, 1945).—Some experiences with the X-ray, Coolidge, W. D. [see also *Amer. J. Roentgenol. and Radium Ther.*, **54**, 583–8 (*Dec.*, 1945)]; X-ray history and development, Coolidge, W. D., and Charlton, E. E.; Industrial X-ray developments, Moriarty, C. D.; X-rays an early Institute topic; Scientific importance of X-rays, Garland, L. H.; 50 years of X-ray progress in Europe.

537.533.74 = 3 1086

**Scattering of rapid electrons by iodine nuclei.** SIGRIST, W. *Helv. Phys. Acta*, **16** (*No.* 5) 471–90 (1943) *In German.*—Wilson chamber experiments on the elastic scattering of rapid electrons (1–3 eMV) by I nuclei give results in agreement with Mott's formula for dependence of effective cross-section on angle, and energy. A. J. M.

537.533.8 1087

**Note on the internal secondary emission and the influence of surface states.** BLOEMBERGEN, N. *Physica, 's Grav.*, **11**, 343–4 (*Dec.*, 1945).—Electrons falling on the surface of a solid liberate secondary electrons, and many measurements have been made on those emitted. Many electrons however remain in the crystal, raised into the conduction bands. An AgCl crystal, subjected to a field of 2 000 V/cm, was bombarded with pulses of 10–500 eV electrons in an attempt to detect the retained secondaries, but no pulses of increased conductivity were observed. Theory indicates a distortion of the normal energy levels in a surface layer about 100 Å thick, which may provide "traps" for the secondary electrons. Experiments with higher energy electrons, capable of penetrating the surface layer, would test this hypothesis. A. J. C. W.

537.534.72 : 621.385.833 = 4 1088

**On the design of a proton microscope.** MAGNAN, C., CHANSON, P., AND ERTAUD, A. *C.R. Acad. Sci., Paris*, **220**, 770–2 (*May* 28, 1945) *In French.*—The limitations of the electron microscope are discussed and the advantages of the proton microscope are pointed out. A magnetic proton microscope would not be practicable since the focal length of a magnetic lens is proportional to the mass of the particle. But an electrostatic proton microscope is a possibility, for the optical characteristics of an electrostatic lens are the same for a beam of protons as for a beam of electrons. The design of a proton microscope of 300 kV is discussed briefly. Its resolving power is 3 Å whereas the resolving power of the best electron microscopes is 50 Å. The poor penetrating power of protons would limit the use of the proton microscope largely to the examination of surface properties and to the study of gases. L. S. G.

537.542.22 : 621.385.1 = 3 1089

**On the clean-up of inert gases in hollow cathodes and the associated processes.** BARTHOLOMEYCZYK, W. *Ann. Phys., Lpz.*, **42** (*Nos.* 7–8) 534–60 (1943) *In German.*—[Abstr. 854 B (1946)].

537.561 : 531.788.7 1090

**Calibration of ionization gauge for different gases.** DUSHMAN, S., AND YOUNG, A. H. *Phys. Rev.*, **68**, 278 (*Dec.* 1 *and* 15, 1945).

537.568 1091

**Ionization and similitude** CLAY, P. H. *Physica, 's Grav.*, **11**, 197–208 (*Dec.*, 1945).—The recombination of ions in ionization chambers is considered. It may be of two types, initial recombination, and volume recombination, the former being independent of intensity, whilst the latter increases with intensity. The effect of the field strength in the chamber and the density and temperature of the gas on the initial recombination is considered. For initial recombination occurring in a straight homogeneous column in an electropositive gas a complicated expression is obtained, which can, however, be simplified for application to experimental cases by choice of conditions. Cluster combination can be dealt with in a similar manner, but in practice, pure cluster recombination occurs only rarely. The method is applied similarly to electronegative gases, and abnormal recombination is also considered. A. J. M.

537.568 : 535.33 1092

**Long duration of the Balmer spectrum in hydrogen.** BORN, M., FÜRTH, R., AND LADENBURG, R. *Nature, Lond.*, **157**, 159 (*Feb.* 9, 1946).—[See Abstr. 2237 (1945), 2604 (1944)].

537.591.1 1093

**The number of high energy electrons present in cosmic rays at sea level.** CLAY, J. *Physica, 's Grav.*, **11**, 304–10 (*Dec.*, 1945).—An arrangement of 5 counters is used to determine the relative number of particles of different energies in cosmic radiation by absorption in Pb. Three parallel counters were placed over a Pb block (A) of which the thickness could be altered between 0 and 20 cm. A layer of Pb was placed above these counters, and four counters were placed below the block A. By determination of multiple coincidences the energy distribution can be found. Electrons with energy greater than $10^9$ eV amount to less than 0·3% of the total number of particles. A number of secondary electrons are produced by mesons. These electrons can produce 2-fold coincidences, and their number is about 10× as great as that arising from electrons falling on the Pb. A. J. M.

537.591.15 1094

**Ionization bursts and extensive showers of cosmic radiation.** CLAY, J., AND 'T HOOFT, C. G. *Physica, 's Grav.*, **11**, 251–69 (*Dec.*, 1945).—Coincidences of ionization bursts were recorded in 2 vessels at different distances and for different shields. For densities of 100–1 500 paths/$m^2$ 60 hours were taken; for very

large bursts of $2 \times 10^4$ to $2 \times 10^5$ tracks/m$^2$ about 20 000 hours were recorded in 4 vessels. In the first series, correlation increases with the size of the bursts up to 100%; for large bursts in open vessels the correlation is 100%. With heavy shielding, however, it is much smaller. The correlation between vessels, one above and one under 110 cm of Fe, proves that the bursts are parts of meson showers. The correlation among bursts in two vessels under 110 cm of Fe is rather small (30%) for a distance of only 25 cm. For very dense bursts ($10^4$–$10^5$ paths per m$^2$) a shield of 12 cm Fe reduces this density just in opposition to the well-known increase by such a shield of the density of bursts of $10^2$–$10^3$ tracks/m$^2$. This means that in the first case the energy seems to be distributed over a greater number of electrons (the shower is more developed) than in the second one where the energy is still more concentrated on the mesons. Good agreement of different observers about the variation of the frequency with the size of the bursts is found. Apparently this is of the order of $N^{-2}$ for the smaller and $N^{-1\cdot4}$ for the larger bursts. Comparison of the number and size of bursts in two vessels with surfaces in the ratio 1 : 3·6 proves that the bursts cannot be produced by one particle only but are a result of a process of greater extension. Therefore it is not possible to calculate the effective cross section along this line.

537.591.5 : [550.38 + 551.51] 1095

**The geophysical aspect of cosmic rays.** DUPERIER, A. *Proc. Phys. Soc., Lond.*, **57**, 464–77 (*Nov.*, 1945).—Twenty-ninth Guthrie lecture. A summary of work on the temperature effect of cosmic rays is given. Results of recent experiments in London, using a battery of Geiger-Müller counters registering triple coincidences, show a gradual increase of correlation with height, indicating that the temperature near the ground is not the only factor responsible for the temperature effect. Part of the variation of intensity at ground level is due to spontaneous disintegration of mesons in the atmosphere. It is assumed that mesons originate at a 75 mm pressure level, and from this the true absorption coefficient in air, and the mean rate of decay of mesons can be calculated. The values obtained are in good agreement with experiment. Cosmic ray records at ground level can be used to foretell the daily mean height of the 75 mm pressure level and hence the mean temperature of the air up to about 16 km. Comparison with experiments with sounding balloons shows general agreement except at times of magnetic disturbance. Expressions for the diurnal variation of cosmic ray intensity, and the diurnal variation of pressure are given. Seasonal changes of the semi-diurnal variations of cosmic ray intensity and pressure follow each other closely, indicating that the former is entirely accounted for by the motion of the meson-producing layer due to barometric variation. The variations of cosmic ray intensity on occasions of magnetic storms are discussed. Smaller changes are frequently accounted for by changes in the geomagnetic field. World-wide variations in general are discussed. A. J. M.

537.722 : 578.087.87 1096

**A modified Zisman apparatus for measuring contact potential differences in air.** ROSENFELD, S., AND HOSKINS, W. M. *Rev. Sci. Instrum.*, **16**, 343–5 (*Dec.*, 1945).—[See Abstr. 4460 (1932)].

537.74 : 621.317.7 1097

**Electrical instruments.** RAYNER, G. H. *J. Sci. Instrum.*, **23**, 31–4 (*Feb.*, 1946).—[Abstr. 794 B (1946)].

537.741.4 1098

**Measurement of electric currents by means of a mercury manometer.** KOLIN, A. *Rev. Sci. Instrum.*, **16**, 378–9 (*Dec.*, 1945).—A sideways pressure is set up when current flows in a liquid conductor at right angles to a magnetic field. With a magnetic field of 2 300 oersted and a conduction chamber 0·6 mm thick a pressure of 3 mm Hg/A was obtained, with a very low internal resistance ($10^{-3}\,\Omega$). The sensitivity can be adjusted by shunting the magnetic field.

538.124 1099

**Note on magnetic energy.** GUGGENHEIM, E. A. *Phys. Rev.*, **68**, 273–6 (*Dec. 1 and* 15, 1945).—Shows that Livens' formulae [Abstr. 1893 (1945)] are particular examples of the formulae of Abstr. 2878 (1936) which apply also to other types of magnetic substances.

538.213 : 621.317.41.029.5/.6 1100

**The permeability of ferromagnetic materials at frequencies between $10^5$ and $10^{10}$ c/s.** ALLANSON, J. T. *J. Instn Elect. Engrs, Pt III*, **92**, 247–55 (*Dec.*, 1945).—[Abstr. 792 B (1946)].

538.22 : 548.0 *see Abstr.* 1150

538.22 : 621.318.22 1101

**Magnetic materials.** BRAGG, L. *J. Instn Elect. Engrs, Pt I*, **92**, 444–51 (*Dec.*, 1945).—[Abstr. 806 B (1946)].

538.222 : 535.37 1102

**Paramagnetism of the phosphorescent state.** LEWIS, G. N., AND CALVIN, M. *J. Amer. Chem. Soc.*, **67**, 1232–3 (*July*, 1945).—It has been shown that the phosphorescent state is a triplet state and therefore paramagnetic. An attempt has been made to measure the paramagnetism using a modification of Theorell's apparatus. When the gas surrounding the phosphor contained $O_2$, a small movement in the expected direction was observed at the moment illumination began but was followed almost immediately by a much larger movement in the reverse direction. A movement only in the expected direction occurred when the surrounding gas was A or $CO_2$. Phosphors were of fluorescein dissolved in boric acid glass and of such concentration and thickness as to absorb nearly all the incident light. Two long thin rectangular samples were used: one, a solid slab of boric acid solution, the other of similar material coarsely ground and attached to a ribbon of cellophane with rubber cement. The magnetic force at 20 000 gauss/cm width was $4\cdot1 \times 10^{-3}$ mg wt for the first sample and $4\cdot7 \times 10^{-3}$ mg wt for the second. Neither of the two results is accurate to better than 10%. [See Abstr. 2940, 1425 (1945)]. W. R. A.

538.311 : 537.122 : 539.154.3 = 4 *see Abstr.* 1113

538.311 : 621.318.4 1103

**Coil systems for producing transverse and longitudinal magnetic gradients.** SHORTLEY, G. H., AND

MAY, A. *J. Appl. Phys.*, **16**, 841–3 (*Dec.*, 1945).—[Abstr. 808 B (1946)].

538.566 : 621.396.6 = 3 1104

**Resonant frequencies of *E*-type waves in a capacitance-loaded cylindrical resonator.** LÜDI, F. *Helv. Phys. Acta*, **17** (*No.* 6) 429–36 (1944) *In German.*—[Abstr. 879 B (1946)].

538.566 : 621.396.611.4 = 4 1105

**Electromagnetic oscillations in ellipsoidal cavities.** JOUGUET, M. *Rev. Gén. Élect.*, **51**, 484–7 (*Nov.*, 1942) *In French.*—[Abstr. 883 B (1946)].

538.691 : 621.385 : 537.291 *see Abstr.* 1078

## RADIOACTIVITY MOLECULES ATOMS 539

539.132 : 535.333 1106

**The isotope effect and the ratio rule.** EDGELL, W. F. *J. Chem. Phys.*, **13**, 539–46 (*Dec.*, 1945).—A perturbation treatment of the isotope effect has been developed which gives the change in the normal co-ordinates as well as the frequencies of vibration. The ratio rule is obtained from this treatment, and the conditions prerequisite to its application are clearly indicated. At present the lack of experimental data limits the utility of this rule, and a more useful but less accurate form has been derived, which depends for its validity upon the ability to construct symmetry co-ordinates which approximate the corresponding normal co-ordinates. The application of these equations to experimental data has been illustrated. In particular the modified ratio rule has been tested on the molecules $CD_4$ $CH_3D$, $CHD_3$, $CDCl_3$, $CD_3Cl$, $ND_3$, $B^{10}F_3$, $C_2D_4$ and $C_2D_6$ are found to give generally good results.

539.15 : 535.338.1 1107

**Positronium.** RUARK, A. E. *Phys. Rev.*, **68**, 278 (*Dec.* 1 *and* 15, 1945).—An unstable atom composed of a positron and a negatron may exist. Its probable spectrum is discussed, and suggestions made for its experimental detection.

539.152.1 1108

**Nuclear spectroscopy and inelastic scattering of particles by nuclei. Energy distribution of charged particles inelastically scattered by nuclei.** GUTH, E. *Phys. Rev.*, **68**, 279–80 (*Dec.* 1 *and* 15, 1945).—Four methods are tested for exploring energy levels of stable nuclei through excitation by inelastic scattering of particles. One method, viz. measurement of the energy distribution of the scattered particles, is discussed in detail for the cases of protons or $\alpha$-particles, deuterons and electrons.

539.152.1 : 539.167.3 1109

**The nuclear excitation of krypton and rhodium.** WIEDENBECK, M. L. *Phys. Rev.*, **68**, 237–9 (*Dec.* 1 *and* 15, 1945).—$Kr^{83*}$ has been produced by the direct X-ray bombardment of the element as well as from $Kr^{82}$ by the $n, \gamma$ process. A study of the nuclear spectrum of $Rh^{103}$ by X-ray excitation gave values of $1{\cdot}26 \pm 0{\cdot}03$, $1{\cdot}64$, $2{\cdot}02$, $2{\cdot}37$, $2{\cdot}71$ and $3{\cdot}05$ eMV for the higher nuclear states which combined with the metastable level. Measurements of the absorption of the conversion electrons in gas indicate that the energy of the metastable state is 40 ekV above the ground level. It was found that $Rh^{103*}$ can also be produced by the direct bombardment of rhodium with electrons.

539.152.1 : 539.167.3 *see Abstr.* 1119

539.152.1 = 3 1110

**A contribution to the two nucleon problem.** BLEULER, K. *Helv. Phys. Acta*, **18** (*No.* 4) 318–42 (1945) *In German.*—The meson field theory with strong coupling is used to investigate all the deuteron states with any total spin $J$ and isotopic spin $K$ It is found that the lowest states are the well-known $^3S$- and $^1S$ states with $J = 1$, $K = 0$ and $J = 0$, $K = 1$ respectively. The next higher isobaric state is the $^3S$ state whose excitation energy lies between 5 and 30 eMV. L. S. G.

539.152.1 = 4 1111

**Structure of the nucleon according to the meson theory with strong coupling.** HONRIET, A. *Helv. Phys. Acta*, **18** (*No.* 6) 473–96 (1945) *In French.*—The mathematics of the meson theory with strong coupling is formulated and applied to electromagnetic perturbations which were previously treated by Pauli and Dancoff [Abstr. 3089 (1942)]. Two negative results are obtained: the proton and neutron appear to have different masses and their magnetic moments are equal and of opposite sign. An attempt is made to overcome these difficulties by examining the non-diagonal terms in the perturbation method. It is concluded that the theory with strong coupling is not able to explain satisfactorily the electromagnetic structure of the nucleon. L. S. G.

539.153 : 535.331 1112

**The energy levels of the configuration $3d^94s5s$ of the copper atom.** BIJL, D. *Comm. K. Onnes Lab. Leiden* (*Suppl. No.* 94). *Physica, 's Grav.*, **11**, 287–302 (*Dec.*, 1945).—The levels of a *dss*-configuration are calculated in central-field approximation using Kramers' symbolic method of vector invariants. The formulae obtained are compared with the experimental data found for the $3d^94s5s$-configuration of the Cu atom in three types of approximation; agreement is not very satisfactory and possible reasons are discussed. In a corollary a preliminary result for the configuration $4d^95s6s$ of the Ag atom is given.

539.154.3 : 538.311 : 537.122 = 4 1113

**Magnetic moment of the electron in the atom.** BRYLINSKI, E. *Rev. Gén. Élect.*, **52**, 249–52 (*Aug.*, 1943) *In French.*—It is shown theoretically that an electron in movement in its orbit of radius $a$ has a mean magnetic moment $M$ over an integral number of periods given by the usual equation $M = vea/2$, where $v$ is the velocity, but instantaneously its magnetic moment is zero. It is proved that in its stable orbits the electron radiates without loss of energy. The mechanism of the process appears to be that when an electron approaches a given region it increases the energy of the region by absorption of waves by the matter traversed. When it leaves a region the excited matter restores the energy to the electron, so that in a complete orbit neither the energy of the electron nor that of the matter will have changed. The intrinsic magnetic moment of the electron due to spin is considered, and it is shown that the hypothesis of a spherical electron must be discarded. Consideration of the force of cohesion within the electron lends support to the vortex model of the electron. A lower limit for the radius of the electron vortex can be

obtained from a knowledge of the magnetic moment of the atom. It is about 10× as great as the radius of the spherical electron. A. J. M.

539.155.2 : 535.338.4 = 3 *see Abstr.* 1036

539.155.4 = 3 1114

**On the definition of Loschmidt's number.** WALLOT, J. *Phys. Z.*, **43**, 530–1 (*Dec.*, 1942) *In German.*—A new definition is given and an application is made to the usual equation of state, $pV = nkT$. There is a comparison with some recent work on the same subject. [Abstr. 1714 (1943)]. L. S. G.

539.163.2 : 539.166.74 1115

**Spectrum of radium ($B + C$) gamma-rays.** ROBERTS, J. E. *Phil. Mag.*, **36**, 264–9 (*April*, 1945).—Experimental results [Abstr. 1908 (1930), 2563 (1927)] are used to calculate the energy distribution in the gamma-ray spectrum of radium ($B + C$) with varying degrees of filtration. The scattering absorption coefficients of heterogeneous radiations are calculated from this distribution and the results are compared with recent measurements of absorption in Al and C [Abstr. 1958 (1945)]. L. S. G.

539.163.2 = 4 1116

**Natural radioactivity by neutron emission.** DA SILVEIRA, M. *Portugaliae Physica*, **1** (*No.* 4) 167–74 (1945) *In French.*—In an examination of the radiations from uranium oxide some anomalies in the $\gamma$-ray absorption in Pb and paraffin wax suggested the existence of a neutron component. This was confirmed by comparing the absorption of this component in $Na_3BO_3$ and $Na_2CO_3$ which gave results consistent with the known absorption cross-sections for slow neutrons for B and C. These results were checked by a control experiment in which the uranium oxide was replaced by a Ra source, when no such selective absorption was revealed. Further, by separating out the $UX_1$ and UY from the uranium oxide it was shown that this neutron emission must be associated with one of the four elements $UX_1$, $UX_2$, UZ, UY. Arguments are put forward suggesting that $^{234}UX_2$ disintegrates by neutron emission to $^{233}UZ$, which is therefore not an isomer of $UX_2$ as had always previously been assumed. The consequent $\beta$-disintegration of $^{233}UZ$ leads to a new isotope of uranium of mass 233 which has, as yet, not been detected, but the fact that it would only occur in small quantities is a possible explanation. W. E. D.

539.166.74 : 539.163.2 *see Abstr.* 1115

539.166.75 = 3 1117

**Resonance absorption of $\gamma$-rays.** ZUBER, K. *Helv. Phys. Acta*, **16** (*No.* 5) 429–31 (1943) *In German.*—$\gamma$-rays produced from the reaction $B^{11}(p, \gamma)C^{12}$, with energies 4·3, 11·8 and 16·6 eMV were passed into paraffin. Although two of these rays are emitted by transitions to the ground state, and should therefore show nuclear absorption in C, there was no additional absorption produced by resonance in paraffin. A. J. M.

539.167.3 = 3 1118

**K-capture and positron emission of 6·7 hr $Cd^{107,109}$.** BRADT, H., GUGELOT, C. P., HUBER, O., MEDICUS, H., PREISWERK, P., AND SCHERRER, P. *Experientia*, **1**, 119–20 (*July* 15, 1945) *In German.*—Investigation of the ratio of the probabilities of the occurrence of *K*-capture and positron emission makes it possible to differentiate between the various theoretical possibilities for the mechanism of $\beta$-decay. The 6·7 hr Cd isotope is particularly suitable for the experimental determination of the ratio. The experimental value is 320 ± 30, which is in good agreement with the value given by Fermi's theory. A. J. M.

539.167.3 : 539.152.1 1119

**Decay schemes for isotopes $W^{187}$ and $W^{185}$.** SULLIVAN, W. H. *Phys. Rev.*, **68**, 277 (*Dec.* 1 *and* 15, 1945).

539.167.3 : 539.152.1 *see Abstr.* 1109

539.167.3 : 551.513.7 1120

**Evidence of increased radioactivity of the atmosphere after the atomic bomb test in New Mexico.** COVEN, A. W. *Phys. Rev.*, **68**, 279 (*Dec.* 1 *and* 15, 1945).

539.17 1121

**Ionization by fission fragments in nitrogen, argon and xenon.** LASSEN, N. O. *Phys. Rev.*, **68**, 230–1 (*Nov.* 1 *and* 15, 1945).—The ratio of ionization produced in these 3 gases by fission fragments of given energy was found to be very nearly the same as for $\alpha$-particles. This helps to justify the measurement of fission fragment energy by comparing ionization with that of $\alpha$-particles of known energy [see Abstr. 531 (1946)].

539.172 1122

**On the disintegration of the deuteron by electron impact.** LUBANSKI, J. K., AND ROSENFELD, L. *Experientia*, **1**, 198–9 (*Sept.* 15, 1945).—The calculations by Peters and Richman [Abstr. 1659 (1941)] of the cross-section for deuteron disintegration by electron impact is modified to include an exchange term consequent on the assumption of a charged meson field. This merely alters both the electric and magnetic cross-section by the same factor, which is independent of the electron energy measured relative to its threshold value. W. E. D.

539.172.3 = 3 1123

**Nuclear photo-effect with ejection of a proton: $Mg^{26}(\gamma, p)Na^{25}$.** HUBER, O., LIENHARD, O., SCHERRER, P., AND WÄFFLER, H. *Helv. Phys. Acta*, **17** (*No.* 2) 139–46 (1944) *In German.*—Absorption measurements have been made on the activity induced in Mg by $\gamma$-rays. Comparison of the effective cross-sections of the photo-effect for light nuclei shows that the activity is due to $Na^{25}$. The maximum $\beta$-energy of $Na^{25}$ is 3·4 eMV. The same half-life is obtained for the product obtained by irradiation of Mg by neutrons, when the $Na^{25}$ is obtained by the process $Mg^{25}(n,p)Na^{25}$. The half-life of $Ne^{23}$ has been redetermined as 40·7 ± 0·8 sec. A. J. M.

539.172.4 = 3 1124

**Nuclear transformations of nitrogen by means of fast neutrons.** FISCHER, C. *Phys. Z.*, **43**, 507–15 (*Dec.*, 1942) *In German.*—Using an Rn–Be source, neutrons with a continuous energy spectrum are produced and these are used in a study of the transformation: $_7N^{14} + _0n^1 = _5B^{11} + _2\alpha^4$. The necessary apparatus (ionization chamber, electrometer, etc.) is described and a method is presented for measuring the energy of the $\alpha$-particles. This energy distribution shows a number of maxima which correspond to discrete energies of the incident neutrons. The neutron energy required to produce such resonance is calculated and

the results are compared with those of other authors [Abstr. 600, 602 and 3201 (1938)]. The spectral terms of the $N^{15}$ nucleus are calculated from the observed max. of the α-particles. L. S. G.

539.185.9 1125

**Collision cross sections for 25-eMV neutrons.** SHERR, R. *Phys. Rev.*, **68**, 240–5 (*Dec.* 1 *and* 15, 1945).—Neutrons with a maximum energy of 25·4 eMV were obtained by bombarding Li with 10·2 eMV deuterons. The reaction $C^{12}(n, 2n)C^{11}$, which has a measured threshold energy of approximately 21 eMV, was used as an energy sensitive detector for the transmission measurements. The cross section obtained for the neutron-proton collision process was $(0{\cdot}39 \pm 0{\cdot}03) \times 10^{-24}$ cm². This is higher than the cross section calculated for *s*-scattering ($0{\cdot}35 \times 10^{-24}$ cm²), but agrees well with the value of $0{\cdot}40 \times 10^{-24}$ cm² predicted by the symmetrical meson theory of Rarita and Schwinger [Abstr. 1356 (1941)]. Measurements on other nuclei ranging from C to Hg show that the collision radius is given by $R' = b + r_0 A^{\frac{1}{3}}$, with $b = (1{\cdot}7 \pm 0{\cdot}4) \times 10^{-13}$ cm and $r_0 = (1{\cdot}22 \pm 0{\cdot}15) \times 10^{-13}$ cm. These measurements are in good agreement with the inelastic cross-section measurements of Grahame and Seaborg [Abstr. 3007 (1938)]. The value of $r_0$ is somewhat lower than the values deduced from *p*, *n* reactions, Coulomb energies, and α-particle decay.

## STRUCTURE OF SOLIDS 539.2

539.214.07 1126

**A new cutting-wire plastometer** LYON, L. L., AND VOLD, R. D. *Industr. Engng Chem.* (*Analyt. Edit.*), **17**, 585–90 (*Sept.*, 1945).

539.216.1 : 591.473 = 397 *see Abstr.* 1179

539.217 : 532.71 : 541.13 1127

**The physical chemistry of membranes with particular reference to the electrical behaviour of membranes of porous character. II.** SOLLNER, K. *J. Phys. Chem.*, **49**, 171–91 (*May*, 1945).—The characteristic behaviour of "dried" collodion membranes with solutions of inorganic electrolytes and those non-electrolytes which are not strongly absorbable must be explained on the basis of the porous micellar-structural character of these membranes; the homogeneous-phase theory of membrane permeability cannot be applied in such cases. The behaviour of highly porous collodion membranes towards the solutions of the various electrolytes is analogous to that of the dried membranes. The dissociable groups located in the interstices of the membranes which determine their electrochemical behaviour can be determined by bare exchange measurements. The high base-exchange capacity of the electrochemically active preparations is due not so much to their higher acid number as to their more open structure. This acid number was determined by electrometric titration. Short-time base-exchange experiments indicate that in membranes prepared even from the most active collodion not more than one in 500 acid groups may be available for the typical membrane functions; with the less active preparations this ratio is estimated to be as high as one in a million. The Teorell, Meyer–Sievers theory characterizes the electrochemical behaviour of membranes by their selectivity constant which is derived conventionally from concentration potential measurements at various concentration levels. H. H. HO.

539.217 : 532.71 : 541.13 1128

**The physical chemistry of membranes with particular reference to the electrical behaviour of membranes of porous character. III.** SOLLNER, K. *J. Phys. Chem.*, **49**, 265–80 (*July*, 1945).—An attempt is made to integrate the experimental results [see Abstr. 237 (1946)] and older observations into a tentative picture of the geometrical and electrical structure of porous membranes. A heteroporous structure must be assumed in order to explain the empirical permeability characteristics of porous membranes for solutes of different mol. wts. and geometrical and electrical heteroporosity must be assumed in order to explain anomalous osmosis. Thus porous membranes must be heteroporous and this is due to more or less random aggregations of the macromolecules and micelles of the membrane. The pore system can be visualized as a sequence of narrow channels and wider cavities, and the electrical behaviour of these systems is governed by the ability or inability of the ions of an electrolyte to penetrate on the basis of size and by the repelling forces emanating from fixed dissociable groups on the pore walls. A tentative picture of the electrical screening effect is given. The above assumptions explain anomalies in the experimental values of the selectivity constant of the Teorell and Meyer–Sievers theory of electrical membrane behaviour. N. M. B.

539.217.3 : 677 : 536.423 = 3 *see Abstr.* 1065

539.26 : 548.73 1129

**Progress of X-ray analysis of organic and fibre structures.** ASTBURY, W. T. *Nature, Lond.*, **157**, 121–4 (*Feb.* 2, 1946).

539.26 : 669.018 : 545.824 *see Abstr.* 1148

## ELASTICITY . STRENGTH RHEOLOGY 539.3/.8

539.311 : 624.15 1130

**Boussinesq's problem for a flat-ended cylinder.** SNEDDON, I. N. *Proc. Camb. Phil. Soc.*, **42**, 29–39 (*Jan.* 1946).—Using the analysis of a previous paper [Abstr. 1621 (1945)] a detailed account is given of the stress distribution set up in a semi-infinite elastic medium by the indentation of the free surface by a flat-ended cylindrical punch of given radius. The medium is assumed to have a Poisson ratio of 0·25 since this is about the value for dense soils and solid granular materials such as sandstone, and the problem is of importance in soil mechanics—especially in the question of the safety of foundations. The results of the calculations are presented in tabular form and the values of the stress components at any point of the medium may be found by interpolation. Graphs are given showing the mode of variation of the stress components. L. S. G.

539.319 : 669.71 = 3 1131

**Internal stresses in aluminium alloys.** FICHTER, R. *Helv. Phys. Acta*, **17** (*No.* 7) 481–508 (1944) *In German.*—Several methods are described by which the internal stresses can be measured, of which the most

important are those in which the change of length of a rod or tube is determined after removing a layer from the surface of the rod, or boring out a layer from the inside of a tube. The material was mostly Al with a few % Cu, Si, Mn and Mg. The stresses are caused chiefly by the hardening process, and can be removed almost entirely by a 2–3% stretch either immediately after quenching or after the cold- or heat-hardening has taken place. In some cases a heating method of removing the stresses can be used. G. E. A.

539.333 : 539.132 *see Abstr.* 1106

539.374 : 551.244 = 4 1132

**Roof-pressure on coal near the face in longwall working. I. Theoretical considerations. II. Distribution of stresses after crushing of the coal. III. Earth pressure round the voids, after fracture of the rock.** VAN ITERSON, F. K. T. *Proc. Ned. Akad. Wet.*, 42 (*No.* 2) 90–104 (1939); 43 (*No.* 2) (1940); (*No.* 3) (1940); (*No.* 4) 412–24 (1940); 44 (*No.* 2) 120–9, (*No.* 3) 230–43 (1941) *In French.*—In I expressions are given for the elastic stresses in the neighbourhood of a circular tunnel, an unworked strip of the coal seam, and a space left by the removal of coal (stope), on the assumption that the coal neither fractures nor glides. There seem to be slips in the mathematics. Parts of chapter II were not available. It appears that the elastic stresses in the rock are found on the assumption that the unremoved coal is plastically deformed, or that it breaks up when the stresses reach a certain limit. In III it is shown that the stresses are insufficient to cause plastic flow in the rock, but are sufficient to shatter it, and the pressures on the linings of tunnels, etc., are found, taking into account the internal friction of the shattered mass. It is shown that the comparatively small pressures exerted by the lining are multiplied many times by the effect of friction, and that the stress at the boundary of the shattered portion of the rock exceeds the static pressure appropriate to the depth. The multiplying effect of internal friction is illustrated by a method of oil-boring or well-sinking through loose sand. If the well is kept full of soft mud or even water no casing is required. A. J. C. W.

539.4.011.1 1133

**The technical cohesive strength of metals in terms of the principal stresses.** MCADAM, D. J., JR. *Metals Techn.*, 5–31 (*Dec.*, 1944).—[See Abstr. 2870 (1943)].

539.4.015 = 3 1134

**On the influence of fibre direction on the strength and elasticity modulus of wood.** STÜSSI, F. *Schweiz. Bauztg*, 126, 247–8 (*Dec.* 1, 1945) *In German.*—The empirical formula

$$\sigma_\gamma = \sigma_\parallel \frac{\cos^2\gamma}{\sqrt{1 + c_1 \sin^2\gamma}} + \sigma_\perp \frac{\sin^2\gamma}{\sqrt{1 + c_2 \cos^2\gamma}}$$

for the variation of the strength $\sigma$ with the angle $\gamma$ between the direction of tension or compression and the direction of the wood fibre is found to represent the experimental results fairly well. With other values for the arbitrary constants $c_1$ and $c_2$ a similar equation can be used for the variation with $\gamma$ of the elasticity modulus $E$ or its reciprocal. A. J. C. W.

539.4.016 : 548.73 = 3 *see Abstr.* 1155

539.42 : 541.68 1135

**Tensile strength in relation to molecular weight of high polymers.** FLORY, P. J. *J. Amer. Chem. Soc.*, 67, 2048–50 (*Nov.*, 1945).—The apparently incongruous statements (*a*) that the tensile strength of cellulose acetate depends explicitly on the number average molecular weight regardless of the molecular weight distribution and (*b*) that the tensile strength of a "blend" equals the weight average of the tensile strengths of the components, can be reconciled only if the tensile strength, molecular weight relationship assumes a particular form. A mathematical analysis leads to the equation $T = a_0 + a_1/M$, where $a_0$ and $a_1$ are numerical coefficients in the expansion of $F(1/M)$, and $M$ is to be replaced by the number average $\bar{M}_n$ when dealing with heterogeneous polymers. The tensile strength of butyl rubber appears to be a linear function of the percentage of the structure permanently oriented by stretching over a wide range of structural variations. The equation is deduced as a special case of this more general dependence, but this interpretation does not apply to cellulose acetate which has no primary valence network. W. R. A.

# PHYSICAL CHEMISTRY 541

541.115 : 536.621.1 *see Abstr.* 1073

## REACTION KINETICS 541.121/.128

541.123.2 : 666.112 : 541.65 *see Abstr.* 1146

541.124 : 577.15.02 1136

**A new hypothesis for the mechanism of activation of substrate molecules by enzymes.** CHAUDHURY, A. K. R. *Curr. Sci.*, 14, 261–3 (*Oct.*, 1945).—The following mechanism is proposed as a preliminary hypothesis. The enzyme molecules are unstable bodies at the ordinary temperature and can give off energy, the transference of which, from enzyme to substrate molecules, occurring by virtue of resonance between some group or atomic vibration in the substrate and some characteristic frequency in the enzyme molecule (primary activation). From this excited group or atom of the substrate molecule, distribution of energy among the various other bands may occur under the influence of the enzyme, so that energy may finally be stored in the band which will be the seat of chemical reaction (secondary activation). It appears possible for the energy required to be absorbed not in a single quantum of certain frequency but in terms of several quanta at a corresponding lower frequency. A further possibility is a stepwise absorption of vibrational energy, the next step of absorption occurring only after excitation has died down by distribution of energy among other bands. The mechanism is illustrated by the case of glucose–1–phosphate→ polysaccharide with phosphorylases. The specificity, inhibition and energy of activation of enzymes and slight change in substrate or enzyme are reviewed in the light of the hypothesis. H. H. HO.

541.126 1137

**Detonation of liquid explosives by impact.** BOWDEN, F. P., MULCAHY, M. F. R., VINES, R. G., AND YOFFE, A. *Nature, Lond.*, **157**, 105 (*Jan.* 26, 1946).—The wide variations observed in impact sensitivities of explosives can be attributed to the profound effect exerted by minute bubbles of included gas. E.g. with nitroglycerine a bubble $5 \times 10^{-3}$ cm in diameter reduced the impact energy required for detonation from $10^5$ or $10^6$ to 20 gm.cm. The detonation is due to the adiabatic heating of the gas in the bubble, and seems to occur when the pressure ratio is about 20 : 1, i.e. a temperature of about 400°c. The explosion probably starts in the vapour phase inside the bubble, and experiments show that only extremely small quantities of gas are required, as low as $3 \times 10^{-11}$ gm. The quantity of heat developed in this mass of gas by compression is only $10^{-7}$ cal.

541.13 : 532.71 : 539.217 *see Abstr.* 1127, 1128

541.136 : 541.183.54 = 4 *see Abstr.* 1142

## PHOTOCHEMISTRY 541.14

541.141.5 1138

**High velocity fragments in secondary photochemical processes.** OGG, R. A., JR., AND WILLIAMS, R. R., JR. *J. Chem. Phys.*, **13**, 586 (*Dec.*, 1945).

## COLLOIDS . ADSORPTION 541.18

541.18 : 532.71 1139

**On colloidally bound water.** KRUYT, H. R., AND DE BRUYN, H. *Proc. Ned. Akad. Wet.*, **43** (*No.* 6) 656–63 (1940).—Greenberg's method of separation of colloid and medium by ultrafiltration, which gives entirely negative results, and Oakley's method of determination of concentration difference by dialysis, which gives results comparable with those of two other established methods, are investigated with modifications and supplementations. Na arabinate is used for the colloid and urea for the molecularly dispersed substance, and calculations are made by comparable methods. Results confirm the apparently paradoxical result that in Oakley's method there is bound water, and in Greenberg's method there seems to be none.

N. M. B.

541.18.041.2 : 535.434 : 535.341 = 4 *see Abstr.* 1037

541.183 1140

**Distribution law, adsorption, and chemical reaction.** GYANI, B. P. *J. Phys. Chem.*, **49**, 442–53 (*Sept.*, 1945).—Adsorption on solids has been treated as a distribution of molecules on isolated points, lines, patches and the entire bulk of the adsorbent. These processes may occur singly or in combination. On this basis, a simple interpretation has been given of the classical adsorption equation, the general facts of adsorption, of adsorption and chemical reaction, and of surface catalysis. The distinction between chemical reaction and adsorption or ordinary distribution is discussed.

H. H. HO.

541.183 : 621.385.833 1141

**An electron diffraction camera for the study of high temperature surface reactions.** GULBRANSEN, E. A. *J. Appl. Phys.*, **16**, 718–24 (*Nov.*, 1945).—[Abstr. 864 B (1946)].

541.183.54 : 541.136 = 4 1142

**Adsorption of cations by active carbon: experimental confirmations.** PALACIOS, J., AND VIGÓN, M. T. *Portugaliae Physica*, **1** (*No.* 4) 296–320 (1945) *In French.*—Following theoretical considerations, investigations are described with the object of verifying that an adsorption cell having an active-C electrode can give a current in complete absence of $O_2$, and of studying the influence of $O_2$ on the operation of the cell. Results show that an active-C element can function in entire absence of $O_2$ by virtue of the adsorption of $Zn^{++}$ ions in the first part of the discharge, and is subsequently transformed into an element for the adsorption of $H^+$ ions. The $O_2$ is, however, shown to act on the adsorbed Zn, giving an oxide which detaches itself from the C, thereby restoring the absorptive capacity of the latter. The Ah-e.m.f. curve thus falls more rapidly as the $O_2$ present decreases. Results accord with the theory of an adsorption origin for potentials.

N. M. B.

541.183.56 : 536.423 1143

**A first-order change which involves the vaporization in two dimensions of *N*-heptane on the surface of silver.** JURA, G., LOESER, E. H., BASFORD, P. R., AND HARKINS, W. D. *J. Chem. Phys.*, **13**, 335–6 (*Nov.*, 1945).

## CHEMICAL STRUCTURE 541.2/.6

541.43 1144

**Pure columbium [niobium].** BALKE, C. W. *Trans. Electrochem. Soc.*, **85**, 89–95 (1944).—After separating Nb from Ta and other constituents by fractional crystallization of complex salts and fractionation of metal chlorides at elevated temperature, a very pure Nb oxide is obtained. A new process for reducing this oxide to pure Nb metal is described. This method is based on the fact that, when an intimate mixture of NbC and $Nb_2O_5$ is heated in a vacuum, Nb metal is produced. This is then converted to Nb metal powder and into Nb metal bars by powder metallurgy. A white, soft, ductile metal is finally obtained whose applications are briefly considered.

541.5 : 549 : 669 : 548.73 *see Abstr.* 1156

541.6 : 534.22 *see Abstr.* 1019

541.62 1145

**On calcium isomerism.** HUBER, O., LIENHARD, O., AND WÄFFLER, H. *Helv. Phys. Acta*, **16** (*No.* 5) 431 (1943).

541.65 : 541.123.2 : 666.112 1146

**The effect of chemical composition on the relationship between refractive index and Abbe value for binary systems.** SUN, K.-H., AND HUGGINS, M. L. *J. Soc. Glass. Tech.*, **29**, 192–6 (*T*) (*June*, 1945).—A procedure is outlined for deriving the relationship between $n_D$ and $\nu$ for binary glass systems, using constants previously published by M. L. Huggins and K.-H. Sun. As an example, the $Na_2O$–$SiO_2$ system is discussed and the results are plotted in two ways. An equation is deduced for the slope of the curve relating $n_D$ and $\nu$ at any composition, and initial values of this slope, at the $SiO_2$ end, are tabulated for various $M_mO_n$–$SiO_2$ systems.

541.68 : 539.42 *see Abstr.* 1135

542.97 1147

**On the catalytic cyclization of aliphatic hydrocarbons. I–II.** HERINGTON, E. F. G., AND RIDEAL, E. K. *Proc. Roy. Soc. A*, **184**, 434–63 (*Nov.* 6, 1945).—I. A mechanism for the process of cyclization is devised on the assumption that the process involves a two-point contact between the catalyst and a pair of C atoms in the hydrocarbon, the ring closing by reaction between a C atom of the chain which is in the gas phase and one of the adsorbed C atoms. Using this model the dependence of total yield of hydrocarbon on the structure of the paraffin may be calculated. The loss of activity of the catalyst with use is a result of the polymerization to giant molecules of the hydrocarbons adsorbed on adjacent catalyst centres. The decay rate may be diminished by decreasing the concentration of active centres on the surface.

II. The products formed by the passage of a number of pure hydrocarbons over an aromatizing catalyst are analysed by a spectroscopic technique. Two different types of isomerization occur. One is exemplified by the formation of *p*- and *m*-xylenes from *n*-octane. This accompanies ring closure and proceeds smoothly at 475°C. The discrepancy between two previous sets of observations on the aromatization of 2.2.4-trimethyl pentane is explained.

L. S. G.

## CHEMICAL ANALYSIS 543/545

545.82 : 535.33.072–15 = 3 *see Abstr.* 1033

545.823 : 537.523.4 *see Abstr.* 1081

545.824 : 669.018 : 539.26 1148

**A simple method for the study of metallic diffusion in certain binary alloy systems.** SULLY, A. H. *J. Sci. Instrum.*, **22**, 244–5 (*Dec.*, 1945).—The determination of concentration gradients due to diffusion in suitable binary alloy systems may conveniently be studied over certain ranges of solid solution by a combination of X-ray diffraction and electrolytic etching techniques. By the use of radiation with high absorption in the metal under investigation, the composition which is obtained from measurements of lattice constants can be made to relate only to metal which lies within 0·001 in or less beneath the surface of the metal. Electrolytic etching in a suitable medium provides a uniform and controllable method of removing metal from the surface of the material. An example is given of the use of this method to determine the fairly steep gradient of Cr content in a thin Ni–Cr alloy wire previously subjected to surface oxidation at high temperature.

545.824 : 669.018 : 548.734.3 *see Abstr.* 1159

545.828 1149

**Background correction in spectrographic analysis.** MITCHELL, R. L., SCOTT, O. R., AND FARMER, V. C. *Nature, Lond.*, **157**, 193–4 (*Feb.* 16, 1946).—A simplified method of calculating the correction.

# CRYSTALLOGRAPHY 548

548.0 : 538.22 1150

**Magnetic studies on cupric ions in crystals.** MOOKERJEE, A. *Indian J. Phys.*, **19**, 63–9 (*April*, 1945).—Magnetic anisotropy and principal susceptibilities of alkali cupric halides have been measured and the results are discussed in relation to crystal structure and Van Vleck's theory. The relative orientations of the paramagnetic units in cupric Tutton salts have been calculated.

548.0 : 669.14 : 620.17 : 621.791.052.2 = 3 1151

**Strength and structure characteristics of arc welds in large thicknesses of plain carbon structural steels.** MONTANDON, R. *Schweiz. Arch. angew. Wiss. Tech.*, **11**, 97–103 (*April*); 147–58 (*May*, 1945) *In German.*—[Abstr. 918 B (1946)].

548.524 1152

**Crystal behaviour of paraffin wax.** FERRIS, S. W., AND COWLES, H. C. *Industr. Engng Chem.*, **37**, 1054–62 (*Nov.*, 1945).—Evidence is presented in support of the following theory: Petroleum waxes consist of mixtures of hydrocarbons belonging to various homologous series. The members of each series crystallize similarly, as either plates, mal crystals, or needles. If but one type (plate, mal, or needle) is present, the crystal form remains the same regardless of such factors as amount or kind of solvent. If the types are mixed, and if the solubility relations are such that more than one type can crystallize simultaneously, either the needle or mal can impress its form on the plate. If, on the other hand, sufficient solvent is present to maintain needles and mals in solution until plates are well established, mals and needles can then deposit upon, and thus take the form of plates.

548.7 = 4 1153

**Present problems in crystal dynamics.** WEIGLE, J. *Experientia*, **1**, 99–103 (*July* 15, 1945) *In French.*—It is shown that thermal motions of atoms can be described by normal modes of vibrations, or by waves, and hence the quanta, called *phonons*, carried by these waves. In terms of this gas of phonons, the dynamics of crystals becomes the kinetic theory of phonons. If the forces between the atoms are harmonic, the phonons behave like an ideal gas. If anharmonic forces are introduced, the gas of phonons is like a real gas, collisions between the particles playing an important part. The anharmonic forces produce waves which do not satisfy the principle of superposition; they can be Bragg-reflected one on another with a strong Doppler effect. A mean free path of the phonons may be defined and then such phenomena as heat conductivity and internal friction are easily interpreted either in terms of waves or phonons.

548.73 1154

**X-ray studies on the systems $Bi_2O_3$–$WO_3$, $Bi_2O_3$–$MoO_3$, PbO–$WO_3$, and PbO–$MoO_3$.** SILLÉN, L. G., AND LUNDBORG, K. *Ark. Kemi Min. Geol.*, **17A** (*No.* 5) *Paper* 21, 11 *pp.* (1944).

548.73 : 539.26 *see Abstr.* 1129

548.73 : 539.4.016 = 3 1155

**Investigation of the rapid deformation of aluminium.** KISTLER, W. *Helv. Phys. Acta*, **16** (*No.* 5) 418–19 (1943) *In German.*

548.73 : 541.5 : 549 : 669 1156

**X-ray diffraction in inorganic chemistry, metallurgy and mineralogy.** LIPSON, H. *Nature, Lond.*, **157**, 124–6 (*Feb.* 2, 1946).—A general survey.

548.73 : 669 1157

**Determination of order parameters from the X-ray diffraction effect.** MACGILLAVRY, C. H., AND STRIJK, B. *Nature, Lond.*, **157**, 135–6 (*Feb.* 2, 1946).

548.734.3 1158

**Structure of isoprene.** CLEWS, C. J. B., AND SCHALLAMACH, A. *Nature, Lond.*, **157**, 160–1 (*Feb.* 9, 1946).—A crystalline X-ray pattern was obtained from a film of pure isoprene at 20°K and 80°K, and the spacings corresponding to 19 lines are given. The unit cell is not cubic, but may be tetragonal. [See Abstr. 2306 (1940), 3517 (1939)].

548.734.3 : 545.824 : 669.018 1159

**The effect of grain or particle size on X-ray reflections from mixed powders and alloys, considered in relation to the quantitative determination of crystalline substances by X-ray methods.** BRINDLEY, G. W. *Phil. Mag.*, **36**, 347–69 (*May*, 1945).—Powders are classified as fine, medium, coarse and very coarse according to the value of $\mu D$ where $\mu$ is the linear absorption coefficient and $D$ is the particle size. A factor, allowing for the absorption in the individual particles, is introduced into the expression for the intensity of X-ray reflection by a constituent of a mixed powder. This factor is negligible for a fine powder but particles of a medium grade powder have appreciable absorption and a factor

$$\tau = V_a^{-1} \int_0^{V_a} \exp\{-(\mu_a - \bar{\mu})x\} dV$$

is necessary. Reflection, in the case of very coarse powders, is a surface effect and the general theory of reflection, concerned mainly with volume effects, is not applicable. The effect of particle size on the relative intensities from mixed powders is considered and some typical numerical examples are given. The application of the theory to alloys and slags containing two or more co-existing phases is discussed. The particle absorption factor for spherical particles is calculated. L. S. G.

## MINERALOGY 549

549 : 669 : 541.5 : 548.73 *see Abstr.* 1156

549.623.5 : 621.315.613.1 1160

**Some physical properties of mica.** HIDNERT, P., AND DICKSON, G. *J. Res. Nat. Bur. Stand., Wash.*, **35**, 309–53 (*Oct.*, 1945).—This paper gives data on the linear thermal expansion, changes in structure, power factors, and effects of heat treatments on the thickness, opacity and colour of micas (muscovite, phlogopite, biotite, ripidolite, and zinnwaldite) from different sources. Tremendous linear thermal expansion was noted for some samples of phlogopite and biotite micas in a direction perpendicular to the cleavage plane. The transitions shown in the expansion curves of these samples at elevated temperatures appear to be related to the structural changes indicated in the X-ray diffraction patterns. Heat treatment of two phlogopite micas and two muscovite micas to 600°c, with or without a load, caused considerable increases in the power factors of the former and only slight changes in the latter. Nearly all the muscovite samples showed the greatest increases in thickness (up to 155%) after heat treatment at 800°c. None of the species of mica can be considered as a substance of fixed and reproducible properties, which depend largely upon the chemical composition, the nature of the crystals, their magnitude and orientation, heat treatment, and the presence of impurities.

## GEOPHYSICS 55

[550.38 + 551.51] : 537.591.5 *see Abstr.* 1095

550.83 1161

**Quantitative interpretation of maps of magnetic and gravitational anomalies by mathematical methods.** KOGBETLIANTZ, E. G. *Quart. Appl. Math.*, **3**, 55–75 (*April*, 1945).—A new method of interpretation is given. In the usual methods use is made of individual values such as maxima, minima, zeros, etc., of the observed and plotted quantity, but the present method uses exclusively average values and, in particular, moment functions and moments of the observed quantity and its square. Two cases are studied, (1) an axial anomaly created by an anticline, and (2) a centred anomaly corresponding to a salt dome. The method described has been used by the author in France and in Iran with good results. A full mathematical theory of the method is presented. L. S. G.

550.93 1162

**Can the "lead method" be used on igneous rocks?** WICKMAN, F. E. *Ark. Kemi Min. Geol.*, **16 A** (*No.* 6) *Paper* 23, 9 *pp.* (1943).—Contrary to Holmes ["The age of the earth" (1937)], it is possible to calculate the age of igneous rocks by the Pb method. Unless the different samples of the differentiated rocks show large differences in radioactivity the method is best used on pre-Cambrian rocks. The amounts of U and Th are determined and the isotopic composition of Pb in the rock is found. A. J. M.

551.018.9 : 551.509.3 1163

**Ocean waves and swell.** *Nature, Lond.*, **157**, 165–6 (*Feb.* 9, 1946).—New methods have been developed for the continuous recording of wave motion in exposed sites using instruments lying on the sea bottom and connected to the shore by submarine cable. One instrument measures the pressure fluctuations below the waves, another is an inverted echo-sounder which records a profile of the surface. A semi-automatic analyser resolves the complex record into its components, and enables early detection of the fast-travelling low long swell from a storm centre. For example, swell with a period of 24 sec from a depression 500 miles away was detected when only a few inches high.

551.244 : 539.374 = 4 *see Abstr.* 1132

## METEOROLOGY 551.5

551.501 : 517.512.2 *see Abstr.* 942

551.508.49 : 551.541 : 621.317.39 = 3 1164

**The electrical measurement of small atmospheric pressure changes.** SAXER, L. *Helv. Phys. Acta*, **18** (*No.* 7) 527–50 (1945) *In German.*—The apparatus consists of a pressure-sensitive capacitance, an h.f. oscillator and recording equipment, and is sensitive to $10^{-4}$ mm of Hg. The capacitance changes are produced by a deflecting tin membrane (0·01 mm thick) which is mounted under constant tension over an adjustable counter-electrode. A capillary tube connects the two sides of the membrane. For pressure changes above 25 cycles/min the response is approximately constant, but for frequencies below 10 cycles/min it falls very rapidly. The h.f. oscillator consists of two initially identical resonance circuits coupled to the same triode. One of these circuits includes the variable capacitance, and it can be shown that under certain conditions small capacitance changes can cause large changes of grid current. The frequency employed is not stated. The grid current is recorded, either by means of a low period mirror galvanometer and light-sensitive paper, or for purposes of continuous operation and for frequencies below 20 cycles/min, by means of an ink recorder in conjunction with a two-stage amplifier. The apparatus is empirically calibrated. The amplitude-response is linear, the slope of the calibration line depending on frequency. Sample recordings show the existence of atmospheric pressure changes of amplitude 0·5 to $5 \times 10^{-4}$ mm Hg and frequency 9–17 cycles/min, the amplitude being modulated at about 1 cycle/min. The possible causes of these fluctuations and their similarity to certain seismographic oscillations are discussed. H. K. H.

551.508.71 : 533.275 = 3 1165

**On the inertia of the torsion hygrometer** KNUDSEN, J. *Met. Ann.*, **1** (*No.* 15) 386–408 (1943) *In German.*—The time lag of a (horsehair) hygrometer is due to complex processes such as water vapour transport through organic cell walls; the simple law: actual R.H. $= R + \alpha dR/dt$ is assumed, where $R =$ indicated R.H. and $\alpha$ is the inertia coefficient. Comparison with a standard psychrometer under various conditions showed that $\alpha$ increases during every adjustment of the instrument, and more so at low R.H. and temperatures; $\alpha$ is less for adjustment to increased R.H. than to lower R.H. The horsehair hygrometer is not recommended for aerological use. The tests are described in detail and the results discussed at length. J. A. W.

551.509.1 : 621.396.9 1166

**Radar as an aid to air navigation and meteorology.** EON, L. G. *Engng J., Montreal*, **28**, 690–4 (*Nov.*, 1945).—[Abstr. 899 B (1946)].

551.509.3 : 551.018.9 *see Abstr.* 1163

551.509.3 : 551.515.41 1167

**On local summer showers in south-eastern Norway.** SPINNANGR, G. *Met. Ann.*, **1** (*No.* 8) 149–206 (1942).—Forecasting for S.E. Norway is based on stability data obtained from aerological aircraft ascents, and synoptic study of weather maps revealing the movement of air masses, with the consideration of the very uneven topography of the region. Methods of calculating the lifting and convective condensation levels are explained, and calculated and observed cloud-base heights are compared and found in fair agreement. The diurnal variation is discussed. The release of precipitation arises from colloidal instability of the cloud considered as an aerosol, and coalescence of drops may be due to an electric field or a rapid upward movement. The conditions of atmospheric instability are discussed and for practical use the criterion is expressed as $\beta/\alpha > 0$, where $\beta =$ (actual lapse rate − moist adiabatic l.r.) and $\alpha =$ (dry adiabatic l.r. − actual l.r.). Actual weather conditions on successive days are discussed in detail for the cases of Arctic air inflow, maritime polar air and continental polar air inflow, and maritime and continental tropical air inflow, using weather maps and aerological data. J. A. W.

[551.51 + 550.38] : 537.591.5 *see Abstr.* 1095

551.510.41 1168

**The helium content of atmospheric air.** GLÜCKAUF, E., AND PANETH, F. A. *Proc. R. Soc. A*, **185**, 89–98 (*Jan.* 10, 1945).—Figures are given for the helium content at various heights up to 25 km above the earth's surface. No variations are found in air samples from all over the surface of the globe, and no significant changes are observed in air up to 20 km. It is concluded that gravitational separation of the constituents has no appreciable effect on the composition of atmospheric air for heights up to at least 25 km. L. S. G.

551.510.535 : 523.72 = 3 1169

**Ionospheric determination of the u.v.-intensities of solar radiation in the range 700–900 Å.** WALDMEIER, M. *Helv. Phys. Acta*, **17** (*No.* 3) 168–80 (1944) *In German.*—If $f_0$ is the limiting frequency of the *E*-layer and $\phi$ the zenith distance of the sun, $f_0^n/\cos\phi$ is proportional to the extra-terrestrial intensity of the radiation producing the ionized *E*-layer. The value $n = 3$ is found empirically. Calculated intensities have an annual course with a sharp maximum in December/January and a flat minimum in late summer. This is attributed to the seasonal variation of the ionospheric temperature. After elimination of the yearly period the extra-terrestrial intensity $S_0$ of the *E*-radiation shows a very close correlation with the solar activity expressed by the relative sunspot figure *R*, the relationship being linear. The *E*-radiation which probably lies in the 700–900 Å region, agrees in its statistical properties with the *W*-radiation deduced by Bartels from the solar-activity-dependent variation of terrestrial magnetism. The latter variation is thus traced exclusively to the *E*-ionization. L. S. G.

551.510.535 : 523.755 = 3 *see Abstr.* 960

551.510.535 : 621.396.11 1170

**On the variation of the refractive index of an ionized medium with collision frequency.** SINGH, B. N. *Bull. Patna Sci. Col. Phil. Soc.* (*No.* 13) 136–43 (*Jan.*, 1943).—[Abstr. 876 B (1946)].

551.511 : 532.511 = 3 1171

**Oscillations and waves in a circular eddy of an ideal gas.** THRANE, P. *Met. Ann.*, **2** (*No.* 1) 1–144 (1944) *In German.*—A circular cylindrical, infinite atmosphere is considered, under the assumptions that temperature

and velocity of the "fundamental current" depend only on the distance ($r$) from the axis; gravity is perpendicular to the axis, and, besides velocity, pressure and temperature, the heat energy content of air particles is taken into account. The Eulerian hydrodynamic equations (in cylindrical co-ordinates) are treated for the case of stationary zonal (fundamental) currents and the equations of perturbation are derived and solved. The conditions that the solutions remain finite are discussed by the aid of the theory of singularities of the differential equations, and it is found that oscillations of the fundamental form are possible in an infinite atmosphere, but not in an atmosphere with a free surface. The possibility of stable proper oscillations is discussed. The theory, developed on purely mathematical lines, is applied to the half-daily variations in the tropical atmosphere, which is nearly cylindrical and barotropic, with special reference to the energy variations and the vertical velocity. In the lower troposphere, the variations of temperature and horizontal velocity are calculated from observation; above observation level, the extrapolated energy variations serve for calculating the other elements. The (gradual) transition from troposphere to stratosphere is treated by numerical integration. It is considered possible that energy variations and friction may serve for explaining the half-daily variations, although resonance may also be effective. If the atmosphere behaves as a simple resonator, the solar tide effect would produce a vertical velocity distribution in agreement with the calculated values. J. A. W.

551.513.2 1172

**Distribution of mass variations in atmospheric air columns.** ÁRNASON, G. *Met. Ann.*, **1** (*No.* 10) 255–79 (1942).—Assuming adiabatic changes and geostrophic wind, but allowing for horizontal divergence of wind velocity in the equation of continuity, as well as for advection, equations are derived from which mass variations in a vertical column of unit cross-section can be determined from soundings at one station. The effect of pressure variation, horizontal divergence and advection on stability is discussed. It is found that advection is important and that, for a particle, the variation in lapse rate depends only upon individual pressure variation and its vertical distribution. Previous investigations (Rossby, Ertel) are critically reviewed. J. A. W.

551.513.7 : 539.167.3 *see Abstr.* 1120

551.515.3 = 3 1173

**On the thermodynamics of tornado formation.** SWOBODA, G. *Experientia*, **1**, 180–3 (*Sept.* 15, 1945) *In German.*—Koschmieder's new thermodynamical theory of tornado formation makes it probable that a tornado (or a waterspout) develops when a warm air pocket rises quickly within the convective mother cloud. The three principal conditions are indicated under which supplementary amounts of potential energy necessary to start a "daughter convection" in the cumulo-nimbus cloud can become available in the latter. Supply of moister air from below seems to be as important as that of warmer air. The suddenness of the release of the supplementary energy cannot be explained by the abrupt annihilation of an intercepting layer within the main body of the cumulo-nimbus, for the pre-existence of such a layer is incompatible with the general character of this type of cloud.

551.515.41 : 551.509.3 *see Abstr.* 1167

551.521.3 : 533.343.4 1174

**On the temperature-pressure effect on absorption of long-wave radiation by water vapour.** PEDERSEN, F. *Met. Ann.*, **1** (*No.* 6) 115–36 (1942).—Assuming that the absorption lines of water vapour have the ordinary dispersion form, required by the theory of collision broadening, a calculation of the absorption in selected lines is carried out for temperatures and pressures corresponding roughly to the conditions at the surface of the earth and at the tropopause respectively. The conclusion drawn is that the stratosphere, as far as the water vapour is concerned, shows almost complete transparency in the region 8–25 $\mu$. The magnitude of the temperature-pressure effect also outside this region indicates the need for taking account of this effect, especially in dealing with problems of the heat exchanges at some height in the atmosphere. The total effect of varying pressure in the path of the ray is shown by an example.

551.541 : 621.317.39 : 551.508.49 = 3 *see Abstr.* 1164

551.577.2 1175

**On the distribution of precipitation over south-eastern Norway when fronts pass from the west or from the south-west.** HALVORSEN, I. *Met. Ann.*, **1** (*No.* 11) 281–322 (1943).—This investigation attempts to prove the theory that only the type of front and the direction from which it came are of importance to the distribution of the precipitation. Three hypotheses have been set up: The distribution is determined by (*a*) the type of front and the direction of arrival; (*b*) the chief factor is the air motion below the frontal surface; (*c*) the wind field in advance of the front and the type of the front are jointly responsible. The material used is from the 1930–39 Norwegian weather charts. The conclusion is that warm fronts, cold fronts and occlusions from a westerly direction give the same distribution of precipitation over the south-eastern district, if the isobars in advance of the fronts are oriented in the same direction. Hypothesis (*c*) is confirmed but knowledge of the wind field in advance of the front is of far greater importance than knowledge of the type of front. The publication contains many diagrams. E. G. M.

551.577.2 1176

**Synoptic studies on precipitation in southern Norway.** SPINNANGR, F. *Met. Ann.*, **1** (*No.* 12) 323–56 (1943).—This paper deals with instability showers in maritime polar air currents from N.N.E., N., etc., round to S.W. Observations from 420 stations have been used. The distribution of showers with the various directions of the wind has been studied for both winter and summer seasons. It is concluded that the mountainous region in southern Norway has a detailed influence on the distribution of instability showers from the sea. In summer, the showers do not reach so regularly over to the lee side of a mountain range as in winter, the maritime polar air being more stable in summer, but land heating may cause local summer showers. Great accuracy in plotting the isobaric chart combined with numerous forecasting rules is necessary to secure successful results. E. G. M.

# BIOLOGY 57/59

577.15.02 : 541.124 *see Abstr.* 1136

578.087.8 : 535.341 *see Abstr.* 1038

578.087.87 : 537.722 *see Abstr.* 1096

578.087.87 : 591.181 *see Abstr.* 1178

591.181 1177

**Resistance artefacts in action potential measurements.** RUSHTON, W. A. H. *J. Physiol.*, **104**, 19–20 (*Oct.*, 1945).

591.181 : 578.087.87 1178

**Giant nerve-fibres.** YOUNG, J. Z. *Endeavour*, **3**, 108–13 (*July*, 1944).—The knowledge (including electrical and optical studies) of the nature of nerve substance and conduction is reviewed. In the squid, conduction rate is about 25 m/sec in the largest nerve fibres, and 5 in the smaller ones; the constant high temperature maintained by birds and mammals increases the speed to over 100 m/sec. The need for further study of nerve conduction and regeneration after injury is urged. C. J. G.

591.473 : 539.216.1 = 397 1179

**Factors determining the development of tension in striated muscle fibre.** BUCHTHAL, F. *K. Fysiogr. Sällsk. Lund Förh.*, **14** (*No.* 16) 197–220 (1944) *In Swedish.*—The magnitude of the tension is determined by the equilibrium length and elastic properties. of the fibre, and as characteristic of the latter, the concept of stiffness (= rate of change of tension with length) is introduced, consisting of pure elastic stiffness, in series with a viscosity-shunted stiffness which becomes blocked in h.f. dynamic measurements. In highly elastic materials, the simple relation: tension = deformation × stiffness, does not hold, and to determine the deformation, it is necessary to know the stiffness as function of the tension. The simplest stable equivalent system is a 3-dimensional molecule chain. To determine the stiffness increase, in contraction, due to increase in tension and that due to change of structure, stiffness values at rest and in contraction are referred to equal tension, and it is shown that, at a critical tension, the stiffness of the contracted fibre suddenly slips. The tension *v.* length curve is thus irreversible, but after the slip has occurred, the new tension *v.* length curve is reversible. An elastic locking takes place. Increased output is obtained if the stimulus is momentarily interrupted. An explanation of these phenomena is attempted. A method for measuring stiffness is sketched, and it is stated that, both at rest and in constriction, the stiffness varies proportional to the tension. The tension is expressed as $y = (\varepsilon^{Fx} - 1)b$, where $F$ = stiffness, $x$ = deformation and $b$ = a const. called the stiffness-tension. Temperature and fatigue effects are briefly discussed and it is pointed out that a complete solution to the problem requires consideration of several fine-structure elements. J. A. W.

## MEDICAL SCIENCE 61

612.7 : 531.767 1180

**The application of a hot wire and thermocouple for recording surface pulsations in the human body.** CRESCITELLI, F., AND GARDNER, E. *J. Lab. Clin. Med.*, **30**, 63–73 (*Jan.*, 1945).—The method utilizes the thermocouple e.m.f. as a small mass of warm air impinges upon the active junction with each pulse. C. J. G.

612.843.3 1181

**Electrophysiological analysis of the fundamental problem of colour reception.** GRANIT, R. *Proc. Phys. Soc., Lond.*, **57**, 447–63 (*Nov.*, 1945).—Describes the results of direct measurements of the nerve impulses caused by stimulation of the retina by light, and points out the different behaviour of the rods and cones. The effect of visual purple on the results for the rods is explained. The author develops his theory of vision as due to a "dominator" which can be synthesized from a set of "modulators," each responding to a fairly narrow region of the spectrum. J. W. T. W.

612.843.611 : 535.7 1182

**Visual dark adaptation: a mathematical formulation.** MOON, P., AND SPENCER, D. E. *J. Math. Phys.*, **24**, 65–105 (*May*, 1945).—The photochemical theory of Hecht is discussed and the equations are modified. The resulting theory agrees well with experimental data, and a large part of the paper is concerned with the fitting of the theory to the experimental results. It is concluded that the new formulation should be of practical value in representing a great mass of data and curves in the compact form of an equation, which may be used to compute adaptation curves in ranges for which there are no data. L. S. G.

614.485 : 621.327.3 1183

**New developments in the application of the germicidal lamp in industrial bacteriology.** BUTTOLPH, L. J. *J. Bact.*, **49**, 203 (*Feb.*, 1945).—Low pressure Hg arcs in recently developed glass tubes transmitting about 65% of the bactericidal u.v. line at 2 537 Å give an over-all efficiency about 5× that of quartz lamps previously used for water disinfection. Intensity of about 0·01 W/ft$^2$ of surface or ft$^3$ of air volume gives practically complete killing of exposed bacteria in 8–10 min, under adverse practical conditions. Spore-forming bacteria, yeast cells and some fungi may require 3–10×, and resistant fungi 50–100×, this exposure. Of the many applications of germicidal u.v. to industrial bacteriology, the disinfection of air economically, in great quantity, to any desired degree with no effect on the air itself is unique. C. J. G.

615.831.4 : 621.327.3 = 4 1184

**Definition and measurement of the biological activity of sources of ultra-violet radiation. The case of mercury vapour lamps used in biology and therapeutics.** DÉJARDIN, G., AND LATARJET, R. *Rev. Opt.* (*Théor. Instrum.*) **22**, 193–205 (*Oct.–Dec.*, 1943). *Rev. Gén. Élect.*, **53**, 281–6 (*Dec.*, 1944) *In French.*—A general survey of recent work, dealing particularly with the establishment of units, relating the energy per cm$^2$ for a particular wavelength with sterilizing action, skin erythema, antirachitic effect and vitamin D formation. The types of lamp available are discussed together with the conditions under which they should be operated, limits being suggested here. Finally, the assessment of lamps is critically considered. After

dealing with the physical methods available it is considered that comparison with standardized lamps is sufficient in practice. A. H.

615.84 : 621.386 : 537.531 *see Abstr.* 1085

615.849 : 389.6 : 621.386 1185

**Standardization of radiological apparatus.** ELLIS, F., MCLAREN, J. W., AND READ, J. *Brit. J. Radiol.*, **19**, 385–90 (*Dec.*, 1945).—This short symposium consists of a summary of the suggestions of radiologists and physicists for the standardization of the main items of equipment in medical radiological departments. There is a considerable measure of agreement on the need for the specification of minimum standards for transformers and electrical gear, including over-all h.t. generator performance. Agreement also exists for the standardization of valve and tube fittings and of basic accessory equipment, to allow easy interchangeability, and for the maintenance of high standards of radiation protection. On the specification of a limited number of standard X-ray beams for therapeutic purposes there is less widespread agreement, as this may be regarded as limiting the radiotherapist's technique. The advantages of such standardization are outlined. J. E. R.

615.849.66 : 621.386.77 1186

**The design of filters to produce "flat" X-ray isodose curves at a given depth.** CHESTER, A. E., AND MEREDITH, W. J. *Brit. J. Radiol.*, **18**, 382–5 (*Dec.*, 1945).—The intensity and dose from an X-ray tube falls off at the periphery of the beam, owing to varying geometrical lengths of the distances transversed by the beam. By multiple field irradiation, uniformity of dose can be obtained at the centres of the fields irradiated. The isodose curves are therefore normally curved. The use of filters to produce an isodose curve of small curvature, i.e. a "flat" curve, by the use of filters has been previously proposed. The present authors describe the design of filters of copper of graduated thickness, to produce isodose curves which are illustrated, having a much flattened contour ensuring greater uniformity of dosage. B. J. L.

616-073.75 : 620.179.152 : 778.33 *see Abstr.* 1190

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666.112 : 541.123.2 : 541.65 *see Abstr.* 1146

666.31 = 3 1187

**From silicon ceramics to metal ceramics.** HAUSER, M. *Schweiz. Bauztg*, **125**, 282–4 (*June* 16, 1945) *In German.*—[Abstr. 696 B (1946)].

669 : 541.5 : 549 : 548.73 *see Abstr.* 1156

669 : 548.73 *see Abstr.* 1157

669.018 : 539.26 : 545.824 *see Abstr.* 1148

669.018 : 545.824 : 548.734.3 *see Abstr.* 1159

669.4/.6 : 531.44 1188

**The frictional properties of some white metal bearing alloys: the role of the matrix and the hard particles.** TABOR, D. *J. Appl. Phys.*, **16**, 325–37 (*June*, 1945).—A description of experiments on a typical Pb-base bearing alloy which consists of a soft matrix in which are dispersed numerous hard crystallites. Measurements of the friction were made at room temperature and at elevated temperatures for clean and for lubricated surfaces. Comparison with a special alloy consisting of the matrix material alone, showed that the hard particles played no appreciable part in the basic frictional and wear properties of the bearing alloy. It is suggested that the frictional behaviour of the bearing alloy is determined essentially by the properties of the matrix material itself although in practical running operations there may be other properties which determine the suitability of the alloy for use in bearings. Similar experiments are described on a typical Sn-base bearing alloy and a corresponding Sn-base matrix alloy.

## PHOTOGRAPHY 77

771.351 : 535.8 = 4 1189

**Experimental comparison of different types of test objects for testing photographic objectives.** PELLIEUX, R. *Rev. Opt.* (*Théor. Instrum.*) **22**, 215–23 (*Oct.–Dec.*, 1943) *In French.*—Continuing earlier work [see Abstr. 640 (1946)] on the comparison of different types of test objects, attention is devoted to the phenomenon of pseudoseparation. It is shown that the use of the Houdaille type of test object is free from errors due to this effect. The Cordonnier test object is also recommended. A. H.

778.33 : 616-073.75 : 620.179.152 1190

**Analysis of the physical factors controlling the diagnostic quality of Roentgen images. II.** MORGAN, R. H. *Amer. J. Roentgenol. and Radium Ther.*, **54**, 395–402 (*Oct.*, 1945).—[See Abstr. 3033 (1945)]. Whilst it is possible theoretically to construct a test object of sheets of lead foil of varying thickness to give linear images, as in light photography, in practice there are difficulties and the test object of windings of varying thicknesses of wire, described in the first paper, is re-described. Tests of 9 types of (U.S.A.) commercial fluorescent screens are detailed. The maximum resolving power of the photographic emulsion is dependent on developmental factors. A formula for the total unsharpness of the image is developed, which is related to the resolving power of the fluorescent screen in terms of the resolving powers of the screen, the lens and the photographic emulsion of photofluorographic (mass radiography) technique. In 35 mm mass radiography these three factors approximate in importance but, in 4 × 5 in technique, the resolution of the screen is below that of the other factors and improvement of screens could result in better resolution. B. J. L.

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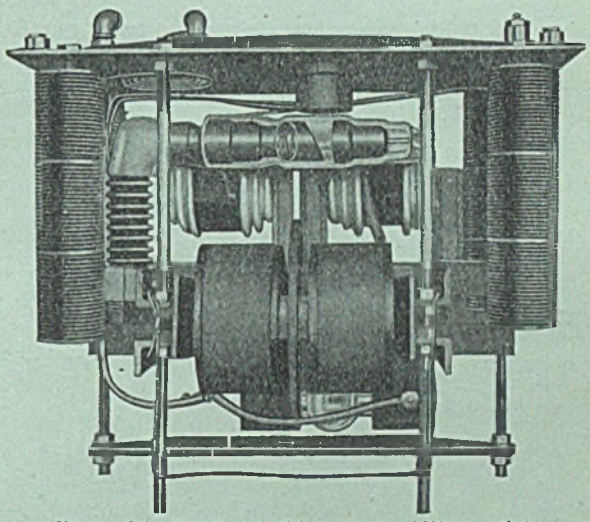

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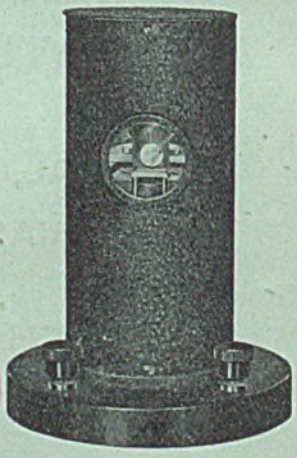

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