PHYSICS ABSTRACTS

SECTION A

of

SCIENCE ABSTRACTS

SECTION A, PHYSICS
SECTION B, ELECTRICAL ENGINEERING

CONTENTS—ABSTRACTS 1919–2080

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538.69 : 541.139   1919

The action of a magnetic field on ferric hydroxide. REYNOLDS, C. B. *Proc. Amer. Phys. Soc., New York, Jan.*, 1945. *Abstr. in Phys. Rev.*, 67, *p.* 202, *March* 1 *and* 15, 1945.—A solution of $Fe(OH)_3$, upon application of a magnetic field, was observed to clear, a deposit appearing on the N. pole of the electromagnet. Reversal of the field reversed the deposit and reversal could be accomplished 3 or 4 times. The action was a function of the amount and concentration of the base used to form the hydroxide, the nature of the base and the nature of the iron salt from which the hydroxide was precipitated.

539.132   1920

Kinetic energy, potential energy and force in molecule formation. COULSON, C. A., AND BELL, R. P. *Trans. Faraday Soc.*, 41, *pp.* 141–149, *March*, 1945.—The virial theorem is used to distinguish between the potential and kinetic energies associated with a molecular bond. The relation between these two energies and the force on a nucleus is investigated, and certain inaccuracies in the literature are corrected. The virial theorem is automatically satisfied for all internuclear distances provided that a scale-factor, which varies with the internuclear distance, is included in the approximate wave function. Unless the virial theorem is satisfied, the potential and kinetic energies are usually much more inaccurate than the total energy of the wave function would lead one to suppose. These points are illustrated by detailed calculations for H_2^+ and H_2, both in their ground state.

539.132 : 535.338.42 : 535.61–1   1921

The infra-red spectra of bent XYZ molecules. I. Vibration-rotation energies. SHAFFER, W. H., AND SCHUMAN, R. P. *J. Chem. Phys.*, 12, *pp.* 504–513, *Dec.*, 1944.—The rotation-vibration Hamiltonian, complete to second order of approximation, is set up for the bent XYZ molecular model. The allowed energies are calculated and expressed in term-value form, $E = hc(G + F)$; the vibrational term G is given explicitly and the elements of the secular determinant are given for evaluation of the rotational term F. The valence-force form of harmonic potential function is discussed for the bent XYY′ model and normal frequencies of HDO are calculated.

539.133   1922

Effect of nuclear electric quadrupole moment on the energy levels of a diatomic molecule in a magnetic field. I. Heteronuclear molecules. FELD, B. T., AND LAMB, W. E., JR. *Phys. Rev.*, 67, *pp.* 15–33, *Jan.*, 1945.—The energy levels of a diatomic molecule—in which one nucleus has electric quadrupole moment and the second zero spin—are derived in weak and strong magnetic fields, and for intermediate fields in the special case of nuclear spin 1. The calculations are made for large molecular rotational quantum number. The transitions which would be induced in a molecular beam resonance experiment are discussed; formulae are given for the energy differences involved in these transitions. The presence of nuclear electric quadrupole moment introduces subsidiary minima into the spectrum; from the energy differences between

these minima, the value of the constant e^2qQ can be derived (e is the electronic charge, Q the nuclear electric quadrupole moment, and q a const., depending on the charge distribution of the rest of the molecule, which must be independently evaluated in each case).

539.133 : 537.226.1 = 82   1923

Theory of polarization of dipole liquids in strong electric fields. ANSELM, A. *J. Exp. Theor. Phys., Acad. Sci. USSR.*, 14, *pp.* 364–369, *Sept.*, 1944.—In a previous article the author demonstrates the unsuitability of the Debye theory of polarization of dipole liquids. The theory of dielectric saturation is here developed, based on the method presented by Kirkwood. Experiment shows that the theory yields the correct order of values for change of permittivity of dipole liquids in strong fields.   E. R. A.

539.133 : 541.57   1924

A relation between bond multiplicity and interatomic distance. KAVANAU, J. L. *J. Chem. Phys.*, 12, *p.* 467, *Nov.*, 1944.—An empirical equation relating the inter-atomic distances of covalent bonds to the bond multiplicity for $C-N$ and $P-P$.

539.133 : 541.57   1925

A modification of Kavanau's relation. LAGEMANN, R. T. *Proc. Amer. Phys. Soc., Atlanta, April*, 1945. *Abstr. in Phys. Rev.*, 67, *p.* 308, *May* 1 *and* 15, 1945.— Examination of the constants of Kavanau's equation [Abstr. 1924 (1945)] shows them to be related to the sum, M, of the atomic weights of the atoms making up the bonded atom pair. If the constant b is $\propto M$ and the constant $a \propto M^{-1}$, we have

$$D = \frac{K_1}{M} + K_2 M \left(\frac{n_1 + n_2 - 1}{n_1 + n_2 + 1} \right)^N$$

where D is the interatomic distance, N the bond multiplicity, and n_1 and n_2 the principal quantum numbers of the valence electrons. K_1 and K_2 are constant for all pairs of atoms having the same value of n_1 and the same value for n_2. For pairs of atoms where $n_1 = n_2 = 2$, the calculated values of the interatomic distance are given by this new relation with an average deviation of $0 \cdot 03$ Å from the observed values.

539.152   1926

Non-coulomb central field for potassium atom. NANDA, J. N. *Indian J. Phys.*, 18, *pp.* 172–176, *June*, 1944.—The potential field for K II is obtained. For the calculation of line intensities or term values it is best to use an empirical field based on experimental observations. The empirical method of Prokofjew is used in preference to those of Sugiura and others. For heavy atoms the field can easily be obtained by the electron subtraction method from the Fermi–Thomas statistical field for neutral atoms. Z_{eff} for K at different values of ρ is given.   A. J. M.

539.152.1   1927

On the meson charge cloud around a proton. BLATT, J. M. *Phys. Rev.*, 67, *pp.* 205–216, *April* 1 *and* 15, 1945.—The calculations of Fröhlich, Heitler, and Kahn for the deviation from the Coulomb law for a proton owing to mesons are re-examined and extended to the scalar meson theory. A perturbation

calculation is used up to terms $\propto$ the (coupling constant)^2, including the recoil of the nucleon to first order in μ/M. The recent Dirac theory, involving negative-energy states of the mesons, in conjunction with the λ-limiting process, makes the theory convergent. The dissociation probability P of a proton in this theory is $\propto$ the (coupling constant)^2 and to μ/M. P is of the order of 2%. The meson charge cloud produces only a slight decrease of the Coulomb force acting on a charged test-particle.

539.152.1 : 530.145   1928

On nuclear forces described by a pseudovector-scalar neutral meson field. HOLMBERG, B. K. *fysiogr. Sällsk. Lund, Förh.*, 14, 22, 6 pp., 1944.—Such forces are considered with particular reference to the deuteron ^3S-state. It is found that the quadripole moment of the ground state vanishes in zero order and first order approx. It is concluded that the case considered cannot give a satisfactory theory of nuclear forces, and this reduces the number of "composition possibilities."   L. S. G.

539.152.1 : 530.145.6 see Abstr. 1679

539.152.1 : 539.172   1929

K to L conversion ratio. LOWEN, I. S. *Proc. Amer. Phys. Soc., New York, Jan.*, 1945. *Abstr. in Phys. Rev.*, 67, p. 203, *March* 1 and 15, 1945.—The relative proportions of electric and magnetic multipole radiation occurring in nuclear transitions may be determined with the aid of the K to L conversion ratio and the absolute values of the internal conversion coefficients. Theoretical calculations which served as a basis for such evaluations are presented in the case of light nuclei ($Z < 50$), (*a*) for the electric multipole case, using Schrödinger non-relativistic theory, (*b*) for the magnetic-multipole case such that the binding energy of the ejected electron may be neglected.

539.152.1 : 539.172   1930

Magnetic multipole conversion for K electrons. GOERTZEL, G., AND LOWEN, I. S. *Proc. Amer. Phys. Soc., New York, Jan.*, 1945. *Abstr. in Phys. Rev.*, 67, p. 203, *March* 1 and 15, 1945.—Formulae for internal conversion coefficients for K electrons in light nuclei are derived for two different approximations: (*a*) non-relativistic, using Schrödinger hydrogen-like wave functions; (*b*) relativistic but restricted to low binding energies. In approximation (*a*), where the spin of the electron is neglected, the magnetic multipole conversion vanishes as a consequence of the parity selection rules. When the electron spin is taken into account, the interaction of the magnetic moment of the electron with the magnetic field of the radiation leads to a finite non-vanishing conversion coefficient for 2^l magnetic multipole radiation.

539.152.1 : 539.185   1931

Neutron-proton scattering and the meson theory of nuclear forces. JAUCH, J. M. *Phys. Rev.*, 67, pp. 125–132, *March* 1 and 15, 1945.—The ratio, R, of the scattering cross-section for 14 eMV neutrons on protons was calculated, assuming for the interaction the expression which results from Schwinger's mixed meson theory. The value of R is determined by the sign of the interaction in P states (repulsive forces for the charge-symmetrical theory). Numerical calculations were carried out to an accuracy for R within 1% for all states of angular momentum $\leqslant 2$. The effect of the higher states is negligible. The result $R = 1 \cdot 11$, is at variance with the ratio of $0 \cdot 52 \pm 0 \cdot 03$ for the same energy. This discrepancy supported by other similar calculations is a strong argument against any charge-symmetrical meson theory.

539.152.1 : 539.185 : 537.534.9   1932

The influence of the recoil of heavy particles on the nuclear potential energy. LOPES, J. L. *Proc. Amer. Phys. Soc., Chicago, Dec.* 1 and 2, 1944. *Abstr. in Phys. Rev.*, 67, p. 60, *Jan.* 1 and 15, 1945.—An attempt to improve the value of the quadrupole moment of the deuteron in Schwinger's mixed meson theory of nuclear forces was made by taking into account the recoil of the nucleons during the emission and absorption of mesons. The interaction energy operator of the system proton-neutron was calculated by perturbation theory and represented by an integral operator in momentum space. In the pseudoscalar and vector symmetrical theories the tensor force has a singularity of the type $1/r^4$ in configuration space; in Schwinger's mixture it has a singularity of the form $1/r^3$. This singularity still remains if relativistic terms are considered, even if recoil is neglected. An evaluation of the quadrupole moment of the deuteron is therefore only possible with a cut-off procedure and this would make unimportant the relativistic and recoil contributions as well as the mixed theory itself.

539.152.1 = 4   1933

Remark on the theory of mixed meson fields. LUBAŃSKI, J. K. *Ark. Mat. Astr. Fys.*, 30B, No. 7, 6 pp., 1944.—A serious difficulty regarding the energy of the field arises in Eriksson's recent result that the dipole term in the static interaction between nuclear particles may be removed by using a vector-pseudovector theory [Abstr. 285·(1945)]. For the pseudovector meson has a negative energy. It is shown that by the introduction of a third particle, pseudoscalar, the dipole term is eliminated automatically.   L. S. G.

539.152.2   1934

Effect of nuclear electric quadrupole moment on the energy levels of a diatomic molecule in a magnetic field. FELD, B. T., AND LAMB, W. E. *Proc. Amer. Phys. Soc., Chicago, Dec.* 1 and 2, 1944. *Abstr. in Phys. Rev.*, 67, pp. 59–60, *Jan.* 1 and 15, 1945.—In molecular beam experiments performed on diatomic molecules of zero electronic spin, effects were observed which seemed to indicate an electrical interaction between the nucleus and the rest of the molecule. The energy-level system and expected molecular-beam resonance spectrum for heteronuclear molecules in which one nucleus has quadrupole moment and the other zero spin, was calculated by the use of perturbation theory, for nuclear spins 1 through 9/2 in weak and strong magnetic fields. The observed effects could be due to a nuclear electric quadrupole moment. Analysis of unpublished data on resonances in LiF give Li^7 the value $qQ = 1 \times 10^{-21}$ erg (Q is the nuclear electric quadrupole moment; q, a quantity, depending on the distribution of charge in the molecule, which must be independently calculated). This may be compared with $0 \cdot 3 \times 10^{-21}$ erg for D in HD and D$_2$.

539.154.2   1935

Non-K-electron capture by nuclei of relatively low isotopic number. ADAMS, E. Q. *Proc. Amer. Phys.*

Soc., Cleveland, Ohio, Sept. 11–12, 1944. *Abstr. in Phys. Rev.*, 66, *p.* 358, *Dec.* 1 *and* 15, 1944.—Based on the table of Hartree and Hartree for the self-consistent field of Hg, it is estimated that only 87·6% of the electrons captured by Hg nuclei are from the K shell, the percentage contribution from the outer shells being, respectively: L, 9·6; M, 2·1; N, 0·5; O, 0·1; and P, 0·006. Since only S electrons have any appreciable probability of being found at the nucleus, the process is more properly called "S capture."

539.154.2 : 537.12 *see Abstr.* 1821

539.155.2 : 535.336.2   1936
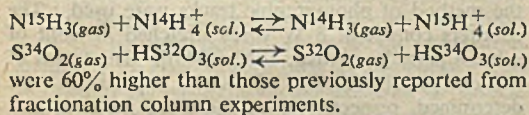**Magnesium ion source for high intensity mass spectrograph.** PI, T. H. *Proc. Amer. Phys. Soc., Pasadena, California, Dec.* 16, 1944. *Abstr. in Phys. Rev.*, 67, *p.* 65, *Jan.* 1 *and* 15, 1945.—Mg ions were produced by bombarding Mg vapour by electrons emitted from oxide-coated cathodes. The ions were focused into a thin sheet by means of an electrostatic lens. This ion sheet was sent into the magnetic lens, which focused the sheet into a small spot where the different isotopes were collected. The ion current obtained at the collector was 120 μA with good resolution.

539.155.2 : 535.336.2 : 541.123   1937
A mass spectrometer and the measurement of isotope exchange factors. THODE, H. G., GRAHAM, R. L., AND ZIEGLER, J. A. *Canad. J. Res. B*, 23, *pp.* 40–47, *Jan.*, 1945.—A 180° direction focusing mass spectrometer for isotope-abundance measurements is described. In operation, the instrument has a resolution of one mass unit in 100. The precision is sufficiently good to make possible the direct measurement of equilibrium constants for isotopic reactions. Reactions previously used to separate the nitrogen and the sulphur isotopes were investigated. The equilibrium constants for the reactions

$$N^{15}H_{3(gas)} + N^{14}H^+_{4\,(sol.)} \rightleftarrows N^{14}H_{3(gas)} + N^{15}H^+_{4\,(sol.)}$$
$$S^{34}O_{2(gas)} + HS^{32}O_{3(sol.)} \rightleftarrows S^{32}O_{2(gas)} + HS^{34}O_{3(sol.)}$$

were 60% higher than those previously reported from fractionation column experiments.

539.155.2 : 621.357.7 : 539.167.3 *see Abstr.* 1959

539.156 : 537.531.85   1938
Theoretical shape of the Compton profile for atoms from H to Ne. DUNCANSON, W. E., AND COULSON, C. A. *Proc. Phys. Soc., Lond.*, 57, *pp.* 190–198, *May*, 1945.—Closed analytical expressions are obtained for the shapes of the modified Compton lines scattered from the elements H to Ne, in atomic form. The widths of the Compton lines are calculated for these atoms, and conditions of resolution from the unmodified lines are obtained. Certain errors in other work on this subject are corrected. The width of the Compton line, as determined experimentally, for diatomic molecules is about 15 to 25% greater than for isolated monatomic atoms.

539.16.08   1939
The mechanism of the Geiger–Müller counter. NAWIJN, A. *Physica, 's Grav.*, 9, *pp.* 481–493, *July*, 1942.—A comparison is made between experiments with G–M counters and theories of instability of the corona discharge. It is pointed out that the behaviour of a counter may be explained by the introduction of a min. current, I_{min}. (the current necessary for the

production of a discharge of mean duration 1 sec.), which for a counter filled with H_2 is about 10^{-6} A. The life time of the discharge in such a counter is measured as a function of the discharge current. The results do not agree with the older theories, but there is better agreement with more recent theoretical work [Abstr. 3348 (1938)].   L. S. G.
539.16.08   1940
The mechanism of the Geiger–Müller counter. II. NAWIJN, A., AND DE JONG, J. *Physica, 's Grav.*, 10, *pp.* 513–530, *July*, 1943.—A continuation of a previous paper [Abstr. 1939 (1945)]. Two groups of counters are distinguished, those with a small value of I_{min}. (about 10^{-6} A), such as counters filled with H_2 or air, and those with a large value of I_{min}. such as some vapour counters (e.g. alcohol vapour). For the first group, 3 periods are considered within a single impulse: the time of development, the life time and the recharging time. These periods are studied, formulae are given for their calculation and it is shown how they vary with the circuit parameters. For the second group only one period is generally considered. The pulse is simple, there being only a small number of subsidiary discharges. Experiments are described investigating the mechanism of generation of the secondary electrons.   L. S. G.
539.16.08   1941
The mechanism of the Geiger–Müller counter. III. NAWIJN, A., AND MULDER, D. *Physica, 's Grav.*, 10, *pp.* 531–543, *July*, 1943.—A further theoretical and experimental study is made of the current I_{min}. [See Abstr. 1940 (1945)], especially its dependence on the pressure of the gas and the dimensions of the counter. The values are given for H_2, air, pure argon and argon with a small amount of alcohol. These are calculated from theoretical and empirical formulae, which follow after calculations of the time needed by an ion and electron respectively to cross the counter. It is explained why counters filled with certain gases give good results while those filled with some other gases do not function. The results of the paper are useful since a high resolving power is obtainable with a large value of I_{min}.   L. S. G.
539.16.08 : 539.163.2   1942
A simple counting system for alpha-ray spectra and the energy distribution of Po alpha-particles. CHANG, W. Y., AND ROSENBLUM, S. *Phys. Rev.*, 67, *pp.* 222–227, *April* 1 *and* 15, 1945.—A system of counters suitable for α-rays is described. If a wire is stretched in front of and insulated from a brass plate and is at a positive potential of about 3 000 V with respect to the plate, it responds to α-rays at atmospheric pressure, but not to very strong β- or γ-rays. With a capacitance of 500 cm. across the counter, a total change of potential of about 50 V is obtained for one incident α-particle. By the use of a power amplifier the arrangement can record 600 α-particles per minute. To make the counter capable of counting at a higher rate the capacitance must be reduced or removed altogether, and an amplifier of higher amplification (multivibrator type) used. To determine an α-ray spectrum in a magnetic spectrograph a counter consisting of eight equally spaced (5 mm.) tungsten wires stretched over a smooth brass plate was used. To prevent the action of the rays on more than one wire at a time aluminium walls were erected between the wires.

The apparatus was used to investigate the spectrum of Po α-particles, for which it gives results agreeing with those obtained from a photographic line. The mechanism of the counter, including the explanation of its non-activation by β- or γ-rays, is considered.

A. J. M.

539.16.08 : 539.163.2 1943

Wall- and salt-absorption corrections in radium-content measurements. PERRY, W. E. *Proc. Phys. Soc., Lond.,* 57, *pp.* 178–190, *May,* 1945.—The measurement of radium content by the γ-ray method involves corrections for the absorption of the radiation in the wall of the container and in the radioactive material itself. Corrections for cylindrical containers constructed of Pt–Ir, Au, a Au–Ag alloy and monel metal have been determined experimentally for wall thicknesses up to 2 mm. and external diameters up to 8 mm., using radium cells and absorbing tubes to simulate radium containers. Measurements of the absorption in powdered materials are described and an empirical formula representing the absorption both for the powdered materials and the metal tubes is deduced. The results provide an experimental basis for the estimation of the absorption in radium salts. and examples of their application to practical cases are given.

539.16.08 : 550.422 *see Abstr.* 2034

**539.16.08 : 621.316.721.076.7 : 621.385.2 : 533.5**
    see Abstr. 1733

539.163 1944

Radioactive scandium. I. HIBDON, C. T., POOL, M. L., AND KURBATOV, J. D. *Phys. Rev.,* 67, *pp.* 289–295, *May* 1 *and* 15, 1945.—Sc^{42}: The existence of this radioactive isotope, reported half-life of 13·4 days, is confirmed. Sc^{43}: This isotope of 3·92 ± 0·02 hr. half-life is produced by the reactions $Ca(d, n)$, $Ca(\alpha, p)$ and $Ca(p, n)$. Positrons of 1·13 eMV and γ-rays of 1·65 eMV are emitted. The ratio of the number of positrons to γ-rays is 4. Sc^{44}: One of the isomers of Sc^{44} decays with a half-life of 3·92 ± 0·03 hr. The positrons and γ-rays have the same energy, 1·33 eMV. Three γ-rays per positron are emitted. Absorption measurements in Al and in Be indicate characteristic X-rays. The other isomer of Sc^{44} has a half-life of 2·44 days. The genetic relation of the isomers of Sc^{44} has been confirmed.

539.163 1945

Radioactive xenons. WU, C. S., AND SEGRÈ, E. *Phys. Rev.,* 67, *pp.* 142–149, *March* 1 *and* 15, 1945.—The methods used in the investigation of the radioactive xenons arising from radioactive iodines produced in uranium or thorium fission, and the results obtained, are reviewed. The following chains have been established:
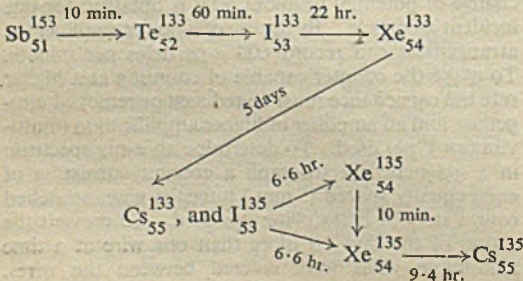

The mass numbers of the whole chain were identified by bombardment of Cs and Ba by fast neutrons. The nuclear isomerism of Xe is discussed. A. J. M.

539.163.2 1946

The β_+-spectrum of C″. SIEGBAHN, K., AND BOHR, E. *Ark. Mat. Astr. Fys.,* 30B, *No.* 3, 4 *pp.,* 1944.—Using a recently constructed β-spectrograph [Abstr. 1361 (1944)] the β_+-spectrum of C″ was investigated. The radioactive sample was obtained by bombarding amorphous B in the form of a powder (specially freed from traces of Zn, Fe, Al and Mg with distilled 10% HCl) with 5 eMV deuterons from a cyclotron. The decay curve obtained is a straight line giving 20·0 ± 0·4 min. as the value for the half-life. The reaction may be expressed as $B_5^{10} + D_1^2 \rightarrow C_6^{11} + n_0^1$

$$\downarrow$$
$$B_5^{11} + \beta_{+1}$$
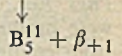
The results are discussed on the basis of the Fermi theory of β-decay. L. S. G.

539.163.2 1947

A study of the alpha-ray spectra by the cyclotron magnet. CHANG, W. Y. *Proc. Amer. Phys. Soc., Chicago, Dec.* 1 *and* 2, 1944. *Abstr. in Phys. Rev.,* 67, *pp.* 58–59, *Jan.* 1 *and* 15, 1945.—An α-ray magnet spectrograph was constructed, consisting of the Princeton cyclotron magnet and a Plexiglas deflection chamber, in which the α-particles can be bent into a semicircle of 75 cm. max. dia. A balance was devised to measure the magnetic field, which is sensitive to 1 in 10 000. A non-linear deflection coil was used to indicate the variation of the field and can also be employed to control directly the magnetic field by allowing a light spot reflected from the mirror of the coil to fall on to a twin photocell, which then regulates the current of the generator exciting field. The photographic method, the counting method, and the method of photographic tracks were used. The counters consist of 8 W wires stretched in front of a brass plate [see Abstr. 1942 (1945)]. The forms of the energy distribution of the Po α-particles were determined, respectively, by the three methods and agree with one another. The half-width is < ¹/₂ mm. (0·01 eMV). Hence, according to the dimensions of the chamber, two lines separated by 0·01 eMV can be resolved.

539.163.2 1948

Short-range alpha-particles from Po. CHANG, W. Y. *Phys. Rev.,* 67, *p.* 267, *April* 1 *and* 15 1945.—[See Abstr. 1947 (1945)].

539.163.2 1949

Radioactive zirconium and columbium. POOL, M. L., AND EDWARDS, J. E. *Proc. Amer. Phys. Soc., Chicago, Dec.* 1 *and* 2, 1944. *Abstr. in Phys. Rev.,* 67, *p.* 60, *Jan.* 1 *and* 15, 1945.—Extended observations on the decay of Zr^{93} and Cb^{93} show a genetical relationship between these two isotopes. Zr^{93} is characterized by a half-life of 67·8 days, a γ-ray of 0·85 eMV, a strong β-ray of 0·29 eMV, and a weak one of 0·8 eMV. The ratio of the intensities is approximately 8. Cb^{93} is characterized by a half-life of 38·7 days, a γ-ray of 0·78 eMV, and soft electrons of 0·140 eMV. The γ-radiation from Zr^{93} rises in intensity with time after a chemical separation of the Cb^{93}; the β-radiation decreases. Cb X-rays were observed by

absorption and also by photography in a curved-crystal spectrograph. The ratio of the number of X-rays to that of γ-rays is approximately $^1/_2$. A new reaction Y^{89} (α, n)Cb^{92} gives Cb^{92} very strongly. The half-life is $10 \cdot 1$ days. A γ-ray of $1 \cdot 1$ eMV is emitted. X-rays were established by absorption measurements and are about as intense as the γ-rays. By the spectrograph, these X-rays are shown to be those of Zr. [Cb (Amer.) $\equiv$ Nb (Brit.)].

539.163.2   1950

Gamma-rays emitted during the radioactive transitions $Sb^{124} \rightarrow Te^{124}$ and $Na^{24} \rightarrow Mg^{24}$. KRUGER, P. G., AND OGLE, W. E. *Phys. Rev.*, 67, pp. 273–281, *May* 1 and 15, 1945.—The γ-ray energies were deduced from stereoscopic photographs of pair electrons formed in the gas of a cloud chamber. An examination of the γ-rays emitted during the nuclear transition $Sb^{124} \rightarrow Te^{124}$ reveals a single monochromatic γ-ray of energy $1 \cdot 70 \pm 0 \cdot 02$ eMV. This agrees with the β-ray spectra. The method is accurate to $\pm 0 \cdot 02$ eMV. For $Na^{24} \rightarrow Mg^{24}$ 11 000 pictures yielded 56 pairs which satisfied the selection rules. Twelve showed no observable scattering and indicate 4 γ-ray lines at $2 \cdot 56$, $2 \cdot 68$, $2 \cdot 76$ and $2 \cdot 89$ eMV. Another pair indicates a weak line at $3 \cdot 24 \pm 0 \cdot 1$ eMV. The relative intensities of β-ray and γ-ray spectra are not incompatible, and the mass difference between the ground states of Na^{24} and Mg^{24} is in agreement with the proposed term scheme.

539.163.2 : 539.16.08 *see Abstr.* 1942, 1943

539.163.2 = 4   1951

Absorption of γ-rays emitted by Uranium I and its immediate descendants. DA SILVEIRA, M. *Portugaliae Physica*, 1, 3, pp. 151–157, 1944.—Since the values obtained by magnetic spectrography for the wavelengths and energies of γ-rays are self-consistent, but do not agree with those obtained by determinations of absorption, the analysis of the γ-radiation from UX has been reinvestigated by the absorption method. Pb and Al were used as absorbers. The absorption curves indicate the existence of several soft γ-rays and a penetrating radiation which has a mass absorption coefficient of $0 \cdot 085$ cm^2 gm^{-1} for Pb and $0 \cdot 063$ cm^2 gm^{-1} for Al, the latter value requiring correction for dispersion. These coefficients give a value of 820 ekV for the energy, corresponding to a wavelength of 15 X.U. for the penetrating radiation, which agrees satisfactorily with the value formerly obtained by magnetic spectrography.

A. J. M.

539.165 : 537.533.74 *see Abstr.* 1863

539.166.2   1952

Gamma-rays from beryllium caused by proton bombardment. HUSHLEY, W. J. *Phys. Rev.*, 67, pp. 34–38, *Jan.* 1 and 15, 1945.—In bombarding thin Be targets with protons of energy $0 \cdot 30$ eMV to $3 \cdot 0$ eMV, γ-ray resonances were observed at proton energies $0 \cdot 975$, $1 \cdot 06$, $1 \cdot 13$, $1 \cdot 36$, and $2 \cdot 52$ eMV and a neutron resonance at $2 \cdot 52$ eMV. For $1 \cdot 04$ eMV protons the value obtained for the γ-ray energy was $7 \cdot 5$ eMV which indicates a radiative capture process. At the $2 \cdot 52$ eMV resonance the measured value of the energy of the γ-rays was about $3 \cdot 0$ eMV. The most probable explanation of the observed resonance at $2 \cdot 52$ eMV appears to be that

it is a resonance for the capture of a proton to form B^{10*} which later disintegrates into ($B^9 + n^1$) and also into ($Li^{6*} + He^4$) where Li^{6*} emits 3 eMV γ-radiation in returning to the ground state.

539.166.2   1953

A "fast" gamma-ray transition. YALOW, R. S., AND GOLDHABER, M. *Proc. Amer. Phys. Soc., Chicago, Dec.* 1 and 2, 1944. *Abstr. in Phys. Rev.*, 67, p. 59, *Jan.* 1 and 15, 1945.—Continues the investigation [Abstr. 697 (1943)] of the γ-ray transition through the presence of a "tellurium-like" satellite among the Sb X-rays emitted in the decay of Te^{121}. This decay leads to two excited states of Sb^{121}, of $0 \cdot 23$ and $0 \cdot 61$ eMV energy. These energies agree with the energies [Abstr. 249 (1944)] of the internal conversion electrons from Te^{121}. The transition from the $0 \cdot 23$ eMV level to the ground state is the "fast" transition, taking place before the K-electron captured by Te^{121} is replaced. The mean lifetime of this state is $< 2 \times 10^{-17}$ sec. and the corresponding half-width > 30 eV. The transition from the $0 \cdot 61$ eMV level to the ground state is slow, and its half-width < 1 eV.

539.166.2   1954

Attempt to detect nuclear resonance absorption of gamma-rays. SCHARFF-GOLDHABER, G., GOLDHABER, M., AND YALOW, R. S. *Proc. Amer. Phys. Soc., Chicago, Dec.* 1 and 2, 1944. *Abstr. in Phys. Rev.*, 67. p. 59, *Jan.* 1 and 15, 1945.—It seemed of interest to search for resonance absorption with the $0 \cdot 23$ eMV γ-ray emitted from a wide level of Sb^{121} [Abstr. 1953 (1945)], resulting from the decay of Te^{121}. No nuclear absorption of this γ-ray in Sb was detected; if present it is $< 3\%$ of the atomic absorption. A search was therefore made for a low lying excited state of Sb^{121}, but no γ-rays above 10 ekV were found. If the $0 \cdot 23$ eMV transition leads to the ground state of Sb^{121}, a new factor must be responsible for a shift of the γ-ray line from the resonance position. As this "fast" γ-ray is emitted with one K-electron missing, while it would have to be absorbed in a neutral Sb^{121} atom, it may be that the interaction of the nucleus with the "hole in the K-shell" leads to a considerable shift of the nuclear level from its "normal" position.

539.166.2   1955

Radiation widths of highly excited nuclei. GOLDHABER, M. *Proc. Amer. Phys. Soc., Chicago, Dec.* 1 and 2, 1944. *Abstr. in Phys. Rev.*, 67, p. 59, *Jan.* 1 and 15, 1945.—Recent evidence for a wide low energy level in a medium weight nucleus (Sb^{121}) is difficult to reconcile with the sharp states found for resonance capture of slow neutrons ascribed to the "slowness" of γ-ray transitions, as observed for some heavy radioactive nuclei. For medium weight nuclei it may be necessary to treat the sharp initial capture state formally as a particular state of the combination $Z^M + n$ rather than as one of the many states of the highly excited compound nucleus Z^{M+1}. For an odd M nucleus, the magnetic interaction with a neutron is comparable in magnitude with the energies found for neutron resonance. For even M nuclei this interaction is usually absent.

539.166.75   1956

Absorption of $2 \cdot 8$ eMV gamma-rays in lead. GROETZINGER, G., AND SMITH, L. *Phys. Rev.*, 67,

p. 53, *Jan.* 1 *and* 15, 1945.—The absorption of Na γ-rays in Pb has been determined by an arrangement which excludes the effect of the low energy component (1·38 eMV). With Pb absorbers of thickness 9·50, 12·13, 14·60 and 19·0 cm. the absorption coefficient was 0·467 ± 0·009 cm.$^{-1}$, agreeing closely with the value predicted by the Klein–Nishina formula (0·46 cm.$^{-1}$), and contrary to the value obtained by Cork and Pidd [Abstr. 1003 (1945)]. A. J. M.

539.166.75 1957

Gamma-ray absorption. CORK, J. M. *Phys. Rev.,* 67, *pp.* 53–54, *Jan.* 1 *and* 15, 1945.—Stronger γ-ray sources from Zn and Co were used in the investigation of the linear absorption of these rays in Fe, Pb, and Cu, than was previously possible [Abstr. 1003 (1945)]. The values obtained for 1·14 eMV and 1·30 eMV radiation agree with the conclusion drawn in the case of the 2·75 eMV radiation from Na, viz., that the Klein–Nishina formula is inadequate at high energies.
A. J. M.

539.166.75 1958

Absorption of radium (B + C) gamma-rays. ROBERTS, J. E. *Proc. Roy. Soc. A,* 183, *pp.* 338–355, *Feb.,* 1945.—New measurements of the absorption of filtered γ-rays from radium (B + C) in Al, C and Pb were made. A small condenser type of ionization chamber was used. From the most recent theories of absorption by scattering, photo-electric effect, and electron-pair formation, total absorption coefficients for Pb over the wavelength range concerned were calculated. The problem of the effective wavelength of a filtered heterogenous γ-ray beam is discussed, and a proposed method of estimation put forward. Comparison of the calculations of μ/ρ with the experimental figures indicates that the photo-electric absorption rises more rapidly with increasing wavelength than is predicted by theory.

539.167.3 : 539.155.2 : 621.357.7 1959

Radioactive iron procedures. Purification, electroplating, and analysis. HAHN, P. F. *Industr. Engng Chem. (Analyt. Edit.),* 17, *pp.* 45–46, *Jan.,* 1945.— A method is described for the purification of Fe solutions containing the radioactive isotopes of this element as obtained from a cyclotron. Radioactive Co, Ni, Mn, Zn and Cu contaminants appearing in varying amounts are removed by use of their limited solubilities in ether. Mn and Zn are further eliminated by their greater solubilities in acid pyridine solution and in alkaline solution. An improved method for electroplating Fe on to Cu or Fe permits the removal of extraneous salts, thus preventing the absorption of weak emanations.

539.17 : 535.338 : 537.531 *see Abstr.* 1849

539.17 : 541.183.65 1960

Progress in the determination of the number of artificially produced radioactive atoms. KURBATOV, J. D., AND KURBATOV, M. H. *Proc. Amer. Phys. Soc., Chicago, Dec.* 1 *and* 2, 1944. *Abstr. in Phys. Rev.,* 67, *pp.* 60–61, *Jan.* 1 *and* 15, 1945.—The method consists in obtaining adsorption isotherms for known minute quantities of divalent ions under conditions such that the exponent in the activated adsorption equation is ≪ unity; then an unknown initial quantity can be found from the adsorption ratio. The adsorption constants were evaluated for radium since

a technique is known for its accurate determination in quantities of < 10^{-8} g. The investigations were extended to obtain the adsorption isotherms of minute quantities of Ba and Sr using the radioactive tracers Ba^{133} and Sr^{89}. With quantities of adsorbent > 10 mg., the exponent in the adsorption equation became 1 for quantities of Ra, Ba, and Sr below 10^{-6} g. and the fraction of ions adsorbed was constant. Thus, to evaluate minute quantities of Ra, Ba, and Sr it appears necessary to use the adsorbents in quantities < 10^{-4} g.

539.17 : 577.16A 1961

Action of ionizing radiations on carotene and vitamin A. CHALMERS, T. A., GOODWIN, T. W., AND MORTON, R. A. *Nature, Lond.,* 155, *p.* 513, *April* 28, 1945.

539.172 : 535.21 1962

Threshold measurements on the nuclear photoeffect. BALDWIN, G. C., AND KOCH, H. W. *Phys. Rev.,* 67, *pp.* 1–11, *Jan.,* 1945.—The h.v. X-radiation from the betatron was employed to produce (γ, n) reactions in elements of atomic number up to 47, the reaction observed by detection of induced radioactivity. The peak X-ray energy was controlled by integrating the voltage on the main coils with an *RC* circuit, which actuated the orbit expander at a predetermined electron energy. Upon irradiating samples at sequences of energies, measuring their activity with β-counters, and plotting activities against peak energy, smooth curves were obtained from which thresholds were estimated. The following thresholds in eMV were measured: C^{11}, 18·7 to 19·4; N^{13}, 11·1 ± 0·5; O^{15}, 16·3 ± 0·4; Fe^{53}, 14·2 ± 0·4; Cu^{62}, 10·9 ± 0·3; Zn^{63}, 11·6 ± 0·4; Se^{79} $^{or 81}$, 9·8 ± 0·5 for the lower, short-period isomer; Mo^{91} $^{or 93}$, 13·5 ± 0·4; Ag^{108}, 9·3 ± 0·5; Ag^{106}, 9·5.

539.172 : 537.531.8 *see Abstr.* 1855

539.172 : 537.531.9 1963

The nuclear isomerism of gold. WIEDENBECK, M. L. *Phys. Rev.,* 67, *p.* 53, *Jan.* 1 *and* 15, 1945.—When Au is irradiated with high energy X-rays a strong activity can be detected either directly or with self-quenching counters. The activity is due to a metastable state of stable $^{197}_{79}$Au produced by line absorption in the reaction $^{197}_{79}$Au + γ → $^{197}_{79}$Au*. The half-life period is 7·5 ± 0·5 sec., and the energy of the metastable level is 250 ekV. The spin of Au* is probably 9/2 or 11/2. A. J. M.

539.172 : 539.152.1 *see Abstr.* 1929, 1930

539.172.3 1964

A new method for determining thresholds in γ-n processes. WIEDENBECK, M. L., AND MARHOEFER, C. J. *Phys. Rev.,* 67, *pp.* 54–55, *Jan.* 1 *and* 15, 1945.—The resonance absorption of neutrons by Rh or Ag is used. The number of neutrons of a given energy in a γ-n process, should vary linearly with the applied voltage, V, when $V > V_t + \dfrac{A}{A-1} V_n$, where V_t is the threshold potential, A the atomic weight of the nucleus being disintegrated, and V_n the energy of the neutron considered. If no substances are present to slow down the neutrons, the detector will be sensitive to only one neutron "line" of energy equal to the resonance energy of the detector, and will not be

affected by faster neutrons. A curve of activity against accelerating potential should give a straight line intersecting the abscissa at the threshold potential. This was tested with both deuterium and Be. The detector was filled with argon-ether mixture and had a Rh cathode. The agreement was satisfactory. The threshold potentials were $1 \cdot 630 \pm 0 \cdot 006$ for Be and $2 \cdot 185 \pm 0 \cdot 006$ for deuterium. A. J. M.

539.172.4 · 1965

Heavy particle groups from the neutron disintegrations of nitrogen and neon. ZAGOR, H. I., AND VALENTE, F. A. *Phys. Rev.*, 67, pp. 133–142, *March* 1 *and* 15, 1945.—Studies of the $_7N^{14}(n, a)_5B^{11}$ reaction, using an ionization chamber coupled to a linear amplifier and recording oscillograph, seem to indicate the emission of heavy particle groups from nitrogen as a result of resonance transmutation by fast neutrons from a Ra + Be source. The total energy of the α-particle plus recoil nuclei lies at $1 \cdot 33$, $1 \cdot 64$, $1 \cdot 94$, $2 \cdot 15$, $2 \cdot 64$, $2 \cdot 98$, $3 \cdot 82$, $4 \cdot 14$, and $4 \cdot 48$ eMV. The data agree with those of other experimenters and it appears unlikely that the maxima in the distribution curve are caused by statistical fluctuations, but are intimately connected with nuclear transformations. Neon yields 3 α-particle groups at $0 \cdot 85$, $1 \cdot 05$, and $1 \cdot 68$ eMV in the energy range $0 \cdot 25$–$2 \cdot 5$ eMV by a similar study. It appears probable that the reaction $_{10}Ne^{20}(n, a)_8O^{17}$ is responsible for the $1 \cdot 68$ eMV group. The association of these groups with the intermediate nuclei Ne^{21} or Ne^{23} is not unique as long as it is not clear which excited states of the end nuclei can occur, and as long as accurate mass values of all the nuclei involved in these reactions are not known. Hydrogen gave a smooth distribution curve, as was expected.

539.18 1966

Evidence for the artificial production of a new neutral radiation. GROETZINGER, G., KRUGER, P. G., AND SMITH, L. *Phys. Rev.*, 67, p. 52, *Jan.* 1 *and* 15, 1945.—A method of distinguishing between γ-rays and neutrons produced in a cyclotron was used, but in the system of counters the observed counting rates under certain conditions were shown to be not the result of neutrons or of γ-rays. The observed radiation was more penetrating than neutrons in H_2O or γ-rays in Pb. It is probable that it consists of neutral particles of low mass (low mass mesotrons). A. J. M.

539.185 1967

Resonance absorption of neutrons in manganese, gallium, and palladium. FEENY, H., AND RASETTI, F. *Canad. J. Res. A*, 23, pp. 12–20, *Jan.*, 1945.—The resonance energy E_r and the absorption coefficient for self-indication K_r were measured for the neutron capture processes leading to the formation of the radioactive isotopes Mn^{56}, Ga^{70}, Ga^{72}, and Pd^{109}. For Mn, the level width Γ was measured. The values are: For Mn^{56}, $E_r = 17$ eV, $K_r = 1 \cdot 3$ cm.^{2}, and $\Gamma = 1 \cdot 67$ eV. For Ga^{70}, $E_r = 100$ eV and $K_r = 3 \cdot 9$ cm.^{2}/g. referred to the absorbing isotope. For Ga^{72}, $E_r = 50$ eV and $K_r = 8 \cdot 2$ cm.^{2}/g. referred to the absorbing isotope. For Pd^{109}, $E_r = 22$ eV and $K_r = 37$ cm.^{2}/g. referred to the absorbing isotope. Part of the measurements were performed employing simultaneously B and the element itself as absorbers. Filtering through B did not affect the absorption

coefficient for self-indication, and filtering through the element itself did not affect the absorption coefficient in B. In the case of Mn, the measured level width led to agreement between the measured absorption coefficient in the thermal region and the one calculated from the one-level formula.

539.185 · 1968

Capture cross section of hydrogen for slow neutrons. SCHULZ, LeR. G., AND GOLDHABER, M. *Proc. Amer. Phys. Soc., New York, Jan.*, 1945. *Abstr. in Phys. Rev.*, 67, p. 202, *March* 1 *and* 15, 1945.—The ratio of the capture cross section of B to that of H is found to be $1\,954 \pm 24$. If we assume for B a capture cross section of 600×10^{-24} cm.^{2}, we obtain for H a capture cross section of $0 \cdot 307 \times 10^{-24}$ cm.^{2}

539.185 : 537.534.9 : 539.152.1 *see Abstr.* 1932

539.185 : 539.152.1 *see Abstr.* 1931

539.185.9 : 537.534.74 *see Abstr.* 1869

539.21 : 631.4 1969

Physics and agriculture: physics of the soil. GARDNER, W. *Amer. J. Phys.*, 12, pp. 311–320, *Dec.*, 1944.—A review of soil physics. Clay is considered as possessing a crystalline structure. Two groups of clay minerals have been recognized, viz., the kaolin group or 1 : 1 type of crystal lattice, and the montmorillonite group or 2 : 1 lattice type. Subjects discussed briefly include (1) the ensemble of mineral particles and their distribution with respect to size, (2) the macroscopic properties of soil, (3) the mechanics of clay, (4) the dynamics of soil moisture, and (5) soil erosion. J. S. G. T.

539.211 : 677 = 3 1970

Surface printing as an aid in the investigation of faults in textiles. SCHWERTASSEK, K. *Melliand Textilber.*, 24, pp. 79–81, *Feb.*, 1943.—Fine structural differences (especially streaks on the surface of rayon textiles) are rendered visible, independently of the gloss or colour of the sample, by taking chemical prints of the surface. Strips of writing paper are completely and uniformly saturated with 3 wt.% aq. KCNS and dried slowly to avoid cockling. The sample is soaked in $1 \cdot 0$ N FeCl$_3$, the excess being removed by light pressure against damp blotting paper. Sample and paper are then pressed in contact between 2 flat glass plates, and the print on the paper is observed in oblique incident light or photographed. With thick, heavily dyed samples 5 wt.% aq. $K_4Fe(CN)_6$ is preferable to KCNS but the prints do not reproduce so well photographically, and they are less permanent. J. G.

539.214 : 539.4 1971

A variational principle for a state of combined plastic stress. HANDELMAN, G. H. *Quart. Appl. Math.*, 1, pp. 351–353, *Jan.*, 1944.—The principle states that among all statically possible stress distributions in a beam under a given torque (satisfying the equations of equilibrium, the condition of plasticity, and the boundary conditions), the actual stress distribution when plastic flow occurs is the one for which the bending moment is stationary. A proof is given of this principle for the case of a beam in a perfectly plastic state under combined torsion and bending by couples, the cross section of the beam having an axis of symmetry. L. S. G.

539.214.9 : 624.15 　　　　　　　　　　 **1972**

Ends and means in soil mechanics. TERZAGHI, K. *Engng J., Montreal*, 27, *pp.* 608–615, *Dec.*, 1944.— Semi-empirical procedures in foundation-engineering are briefly reviewed. Subjects discussed include: soil classification based on grain size; the soil classification chart developed by the United States Public Road Administration; significant properties of sands and clays; Atterberg limits of clays, viz. liquid, sticky and plaster limits; prerequisites for the practical applications of soil mechanics, and the past and future of soil mechanics. To-day the intensity of earth pressure can be computed to within ± 15–20% from the average of results of unconfined compression tests on seamless-tube samples. 　　　　 J. S. G. T.

539.216.1 　　　　　　　　　　　　　 **1973**

The optimum conditions for setting strained animal fibres. HIND, J. R., AND SPEAKMAN, J. B. *J. Text. Inst., Manchr*, 36, *pp.* T19–T34, *Feb.*, 1945.

539.216.1 　　　　　　　　　　　　　 **1974**

Examination of resin-treated fibres with the electron microscope. REYNOLDS, D. H., AND RICH, J. A. *Proc. Electron Microscop. Soc. Amer., Chicago, Nov.*, 1944. *Abstr. in J. Appl. Phys.*, 16, *p.* 263, *April*, 1945.—Fibres treated with 4 different types of resin were considered. Out of an extended study, two kinds of fibres have been chosen for discussion as showing the type of results obtained—light cotton sheet and 50/50 acetate-viscose. The fabrics were broken down mechanically by high-speed stirring in water suspension, with careful avoidance of any chemical disintegration. The resulting disintegration pattern shown by the electron microscope correlates well with observed physical properties.

539.216.1 　　　　　　　　　　　　　 **1975**

Fine structure in the fibre-axis macroperiod of collagen fibrils. SCHMITT, F. O., HALL, C. E., AND JAKUS, M. A. *Proc. Electron Microscop. Soc. Amer., Chicago, Nov.*, 1944. *Abstr. in J. Appl. Phys.*, 16, *pp.* 263–264, *April*, 1945.—Electron micrographs of collagen fibrils appropriately treated with stains reveal fine structure within the 640 Å fibre-axis macroperiod previously demonstrated by X-ray diffraction and electron-microscope studies. Whereas electron micrographs of unstained fibrils show a single dark band in the macroperiod, stained fibrils show 5 dark bands, each having a characteristic position within the period and a characteristic relative density. Two of the bands were resolved as doublets in highly stretched fibrils.

539.216.1 : 539.217.5 : 531.72 *see Abstr.* 1697

539.216.1 : 541.183 : 532.72 *see Abstr.* 1727

539.216.1 : 677 = 3 　　　　　　　　 **1976**

"Zellwolle" investigations. I. Comparative tests of fibres of the wool type. BÖHRINGER, H. *Melliond Textilber.*, 24, *pp.* 59–64, *Feb.*, 1943.—An attempt is made to characterize and identify sheeps' wool and "zellwolle" fibres in terms of the microscopic characteristics of the cross-section and the fibre surface, (photomicrographs reproduced); the frequency curves of the fibre staple or fibre width (W) (or preferably of the deviation of W or W^2 from their respective means); the swelling capacity; and of the whiteness and the gloss ("zellwolle" is whiter and glossier than is sheeps' wool). 　　　　　　　　　　　 J. G.

539.216.1 : 677.2 : 539.264 = 3 *see Abstr.* 1985

539.217.3 : 676.2 　　　　　　　　　 **1977**

Alumina content of rosin-free handsheets in relation to tub sizing. ROWLAND, B. W., AND HARRISON, J. J. *Paper Tr. J.*, 119, *TAPPI Sect., pp.* 199–203, *Nov.* 16, 1944.—Colloidal Al_2O_3 sols produce water resistance in handsheets made from bleached sulphite pulp to which they have been added, and to a lesser extent, resistance to oil and to ink also. They also produce strength characteristics equal to or slightly greater than those of sheets from which they are absent. The presence of alum destroys water resistance and reduces the strength properties. On tub sizing sheets containing the Al_2O_3 with starch, the higher the proportion of Al_2O_3 present, the higher is the water resistance and the lower is the effect of the starch; all the sheets were brought to approx. the same strength by the tub sizing regardless of their strengths initially. Methods are described for determining the electrostatic charge on the cellulose fibres; the presence of Al_2O_3 makes the sheet less negative. 　 J. G.

539.217.5 : 539.216.1 : 531.72 *see Abstr.* 1697

539.217.5 : 676.4 　　　　　　　　　 **1978**

Air resistance of paper. Corrected TAPPI tentative standard T460 m–43. *Paper Tr. J.*, 119, *TAPPI Sect., pp.* 221–222, *Dec.* 7, 1944.—The conditioned sample is held between clamps so as to close the top of a hollow, open-ended, light-metal cylinder, which can slide freely up and down in an outer vertical cylinder containing a light spindle oil (Saybolt Universal viscosity, 60–70 sec. at $37 \cdot 8°$). The rate of fall is a measure of the air resistance of the paper, which is reported as the time (sec.) for 100 cm.^{3} to be displaced through 1 in.^{2} of paper. Reproducibility, 5% for 40 sec., 10% for 300 sec. Crêped and corrugated papers cannot be tested in this way. 　 J. G.

539.219.1 : 669.22 　　　　　　　　　 **1979**

Some effects of oxygen in silver and silver alloys. CHASTON, J. C. *J. Inst. Met.*, 71, *pp.* 23–35, *Jan.*, 1945.—When oxygen-free Ag containing $0 \cdot 01$–$0 \cdot 02\%$ of metallic impurities is annealed in air, a zone of fine grains is formed directly beneath the surface, while in the interior of the metal recrystallization and grain growth proceed normally. No such zone is formed when this metal is annealed in vacuum or in H_2. When oxygen-bearing Ag containing these traces of impurities is heated in H_2, the metal is embrittled by a reaction similar to that produced by hydrogen-annealing tough-pitch Cu. The mechanism of these reactions has been followed by heating strips of Ag exposed on the one side to O_2 and on the other to H_2. Neither grain-growth restraint nor hydrogen embrittlement is observed in very pure Ag, and it is suggested that the effects in the less pure metal may be due to distributed particles of metallic oxides formed by internal oxidation. Alloys of silver with small amounts of Al or Zn are hardened for a small distance below the surface when annealed in air, apparently as a result of a similar mechanism. A reversed-precipitation effect can also be produced if Ag containing O_2 in solution is heated in the vapour of Zn, which presumably diffuses into the Ag and combines with the O_2 in solution.

539.26　　　　　　　　　　　　　　　　1980
X-ray diffraction—an industrial tool. BUHLER, J. S. *Metals and Alloys*, pp. 1316-1318, *Nov.*, 1944.—Describes a recently developed X-ray diffraction equipment and discusses its industrial applications.
M.-V.

539.26　　　　　　　　　　　　　　　　1981
X-ray diffraction. WEILL, A. R. *Iron and Steel*, pp. 741-749, *Dec.* 7, 1944.—Methods are briefly described from the point of view of their practical application. The data obtained are applied to the determination of the structures of metals and alloys and thence to the identification of materials and their quantitative analysis, the establishment or verification of equilibrium diagrams, the measurement of internal stresses and the effects of cold working. M.-V.

539.26　　　　　　　　　　　　　　　　1982
Study of the relative intensities of lines in fibre X-ray camera photographs. OWEN, E. A., AND EDMUNDS, I. G. *Phil. Mag.*, 36, pp. 54-66, *Jan.*, 1945.—It is shown that by carefully preparing the powder specimen it is possible to use a fibre camera in the investigation of the relative intensity of lines in structure spectra. The relative values of the scattering factor for Cu and Au obtained with a fibre camera and copper $K\alpha$ radiation are given and there is satisfactory agreement at room temperatures between the values for Cu calculated from the measurements of lines in fibre camera photographs and those calculated from the measurements of lines in flat powder plate photographs. L. S. G.

539.26　　　　　　　　　　　　　　　　1983
The texture of polythene. BUNN, C. W., AND ALCOCK, T. C. *Trans. Faraday Soc.*, 41, pp. 317-325, *June*, 1945.—The interpretation of some secondary features of the X-ray diffraction patterns of polythene—the breadth of the crystal reflections, and the position of the diffuse band—is considered. X-ray diffraction patterns were taken at temperatures up to the m.p. ($\sim$120°C.). Changes in the proportions of crystalline and amorphous material occur above 80°C. The a edge of the orthorhombic unit cell of the crystalline part increases in length from $7 \cdot 42$ Å at 18°C. to $7 \cdot 65$ Å at 100°C. The b axis remains approx. constant at $4 \cdot 93$-$4 \cdot 95$ Å. Optical evidence indicates a spherulitic structure. The orientation of the crystals in the spherulites is deduced by reference to the optical properties of drawn fibres. On heating, the temperature at which the material becomes isotropic varies with different specimens; the highest temperature observed in any specimen was 126°C.

539.26 : 539.379　　　　　　　　　　　1984
Comparison of the structures of stretched linear polymers. HUGGINS, M. L. *J. Chem. Phys.*, 13, pp. 37-42, *Jan.*, 1945.—Published X-ray data from crystalline Se and Te and from stretched S (amorphous), polyethylene, polyisobutylene, polyvinyl alcohol, polyvinyl chloride, polyvinylidine chloride, polyoxymethylene, polyoxyethylene, polyethylene disulphide, polyethylene tetrasulphide, and polyphosphonitrile chloride are compared. In most cases the experimental identity distance in the direction of the chain axes and the expected interatomic distances and interbond angles agree with the assumption that the chain atoms form a regular spiral, unidirectional in each chain and of uniform pitch. Apparent exceptions are briefly discussed.

539.264 : 539.216.1 : 677.2 = 3　　　　1985
Fine structure and properties of natural and artificial fibres. I. HESS, K. *Melliand Textilber.*, 24, pp. 289-293, *July*, 1943.—Existing theories of this relationship are based principally on the molecular dimensions of the fibre and are inadequate to explain all the known facts. X-ray methods are therefore used to investigate the natural origin of the cotton fibre, and in particular the growth of the outer layers of the fibre wall. X-ray photographs taken at various stages of development, and before and after extraction with various solvents (which minimize interference by non-cellulosic constituents, e.g. pectins, fats, waxes, carbohydrates, proteins, phosphatides) are used as a guide in building up a schematic diagram showing the positions of these constituents in the primary wall of the cotton fibre. Observation of fibres which have been swollen in cuprammonium, under the microscope in ultra-violet light, shows that the lamella of the secondary wall exists as threadlike fibrillae, 2 000-3 000 Å thick. Further structural details are revealed by the electron microscope, especially after treatment of the fibre in a swinging-hammer mill.
J. G.

539.266 : 532.7 *see Abstr.* 1726

539.3　　　　　　　　　　　　　　　　1986
Direct determination of stresses from the stress equations in some two-dimensional problems of elasticity. IV. Problems of wedges. SEN, B. *Phil. Mag.*, 36, pp. 66-72, *Jan.*, 1945.—The method for determining the stress, developed in previous papers [Abstr. 2318 (1939)], is here applied to problems concerning wedges of isotropic or nonisotropic material. The stress function is not used in this method. A particular problem connected with a wedge of aelotropic material of a type considered previously is solved completely. L. S. G.

539.31　　　　　　　　　　　　　　　　1987
The thermal-stress and body-force problems of the infinite orthotropic solid. CARRIER, G. F. *Quart. Appl. Math.*, 2, pp. 31-36, *April*, 1944.—Two problems dealing with the stresses and displacements in an infinite orthotropic solid are solved, the results being expressed, in each case, in terms of 3 independent displacement potentials. These are found for an arbitrary distribution of temperature or body force within a finite region of the solid. The expressions for the potentials are reduced to the form of Newtonian potential integrals in some cases (where there is sufficient symmetry) and in more complicated cases the results are expressed in closed form as definite integrals. L. S. G.

539.31　　　　　　　　　　　　　　　　1988
Surfaces of maximum shearing stress. THOMAS, T. Y. *J. Math. Phys.*, 23, pp. 167-172, *Nov.*, 1944.—At each point of an elastic medium in equilibrium under the action of applied forces there are, in general, 2 plane perpendicular surface elements having max. shearing stress. These surface elements form 2 families and conditions are derived for the elements of such a family to generate a system of surfaces covering the medium, i.e. for the existence of surfaces

such that the plane element of the family at any point is tangent to the surface passing through that point. The mathematics involves a knowledge of tensor analysis.   L. S. G.

539.31   1989

Note on the theorem of the symmetry of the stress tensor. REISSNER, E. *J. Math. Phys.*, 23, *pp.* 192–194, *Nov.*, 1944.—The stress tensor is not symmetrical when "body moments" (e.g. in the case of magneto-striction) are present, but it is shown that the absence of "body moments" is not sufficient to ensure symmetry. A simple example is discussed to show that the proof of the symmetry involves the condition that the rates of change of the stress components remain finite.   L. S. G.

539.31 : 517.512.2 *see Abstr.* 1615

539.31 : 539.893   1990

On the theory of the tension of an elastic cylinder. MURNAGHAN, F. D. *Proc. Nat. Acad. Sci.*, *Wash.*, 30, *pp.* 382–384, *Dec.*, 1944.—A continuation of a previous note [Abstr. 1026 (1945)]. A theory of the traction of an elastic cylinder is presented, in which allowance is made for the lack of isotropy caused by the applied traction. It is pointed out that the yielding of the cylinder under traction may be explained without the drastic hypothesis that the strain matrix is diagonal.   L. S. G.

539.32 : 539.434 : 678 : 620.1.05   1991

Some low-temperature properties of elastometers. CONANT, F. S., AND LISKA, J. W. *J. Appl. Phys.*, 15, *pp.* 767–778, *Nov.*, 1944.—A modification of previous apparatus used to measure the Young's modulus at low temperatures is described. The effects of various softeners on the low-temperature bending moduli and the brittle-point temperature of stocks based on four butadiene–acrylonitrile (B/A) type copolymers are given, and also bending-modulus curves and brittle-point temperatures for typical test stocks based on Thiokol FA, and "mass" and "emulsion" polymerized polybutadiene. Continued exposure to low temperature affects the Young's modulus of some but not all vulcanizates. A method for measuring and evaluating creep under dead load at low temperatures is presented. The creep constant defined reaches a maximum at a definite temperature.   L. S. G.

539.32 : 578   1992

Some physical properties of elastomers at low temperature. GREENE, H. E., AND LOUGHBOROUGH, D. L. *J. Appl. Phys.*, 16, *pp.* 3–7, *Jan.*, 1945.—Rubbers are characterized by the temperature at which they become brittle and by the width of the transition region, the sharpness of the transition between the elastic and glassy states being greatest when the testing time is long compared to the molecular relaxation times. Simple apparatus is described for measuring the elastic constants, at slow rates of extrusion, for moderate extensions. 5 pure gum elastomers are studied, neoprene FR, Butyl rubber, GRS, natural rubber and polybutadiene, and for each of these the modulus/temperature curve is given. Addition of plasticizer shifts this curve down the temperature scale without producing a significant change in shape. Addition of reinforcing materials decreases the sharpness of the transition.   L. S. G.

539.32 : 678   1993

Limiting law of the reinforcement of rubber. SMALLWOOD, H. M. *J. Appl. Phys.*, 15, *pp.* 758–766, *Nov.*, 1944.—The effect of filler upon the modulus of compounded rubber is calculated, and it is found that the increase in modulus is proportional to the volume loading and is independent of the particle size of the filler. The stress system in the vicinity of a spherical filler particle is also calculated and there is experimental confirmation of the results. It is deduced that carbon black is flocculated in rubber and that P–33, Thermax and Gilder's whiting are completely dispersed in rubber. Kadox and XX zinc oxide give unusually large increases in modulus, and this is ascribed to alteration of the type of cure of the rubber matrix. Catalpo clay shows excessive modulus because of high calendar grain.   L. S. G.

539.32 : 678.7   1994

Some relations between stress, strain, and temperature in a pure-gum vulcanizate of GR–S synthetic rubber. ROTH, F. L., AND WOOD, L. A. *J. Appl. Phys.*, 15, *pp.* 749–757, *Nov.*, 1944.—The stress/temperature relations were studied at constant elongation and length and these yield information useful in calculations in the theory of the elastic behaviour of the rubber. Practical data regarding the tensile properties of the rubber are also obtained. The specimens were first held at constant length and temperature for $\frac{1}{2}$ to 2 hours, after which time the effects of relaxation of stress during the observation of stress/temperature relations are negligible. The value of the stress after relaxation at each elongation was used to plot a stress/strain curve, and the stress/temperature relations for temperatures (t) below the relaxation temperature (T) are linear. When $t > T$ the linearity is lost. The intercepts at $0°K.$ for the lines obtained when $t < T$ are useful in evaluating the internal energy changes.   L. S. G.

539.32 : 678.7   1995

Stress/temperature relations in a pure-gum vulcanizate of natural rubber. WOOD, L. A., AND ROTH, F. L. *J. Appl. Phys.*, 15, *pp.* 781–789, *Nov.*, 1944.—Results of a similar type to those of a previous paper [Abstr. 1994 (1945)] are presented. Crystallization, which is easily recognized, is of considerable importance in interpreting the results.   L. S. G.

539.37   1996

Use of sine transform for non-simply supported beams. STRANDHAGEN, A. G. *Quart. Appl. Math.*, 1, *pp.* 346–348, *Jan.*, 1944.—The sine transform of a function $y(x)$ in the interval $(0, l)$ is

$$S[y(x)] = \int_0^l y(x) \sin (n\pi x/l)dx = v(n)$$

$$(0 < x < l; \; n = 1, 2, \ldots .)$$

and it is simply related to the coefficients of the Fourier sine series of $y(x)$. An application is made to the solution of the differential equation describing the deflection of a beam with axial and transverse loading.   L. S. G.

539.37   1997

The treatment of discontinuities in beam deflection problems. BROWN, C. L. *Quart. Appl. Math.*, 1, *pp.* 349–351, *Jan.*, 1944.—The differential equation determining the deflection (usually solved separately

over several sections of the beam) is here solved in one stage by using Heaviside's unit step function. An example is given.   L. S. G.

539.37   **1998**

The stress distribution due to a force in the interior of a semi-infinite elastic medium. SNEDDON, I. N. *Proc. Camb. Phil. Soc.*, 40, *pp.* 229–238, *Oct.*, 1944.— Expressions for the components of stress and components of the displacement vector are deduced when the force is applied at a single point. It is next supposed that the applied force is distributed uniformly over an infinite strip of finite breadth parallel to the boundary of the medium. The stress distribution on the boundary is found and simple expressions are deduced for the stress components at an interior point. Numerical results are given to show the variation of stress throughout the medium and a comparison is made with the results of a previous paper [Abstr. 1830 (1944)]. The effect of compressibility of the medium is considered briefly.   L. S. G.

539.37 : 608.4 *see Abstr.* 2060

539.379   **1999**

Control of elongation in highly stretched cotton tire cord. PHILIPP, H. J., AND CONRAD, C. M. *J. Appl. Phys.*, 16, *pp.* 32–40, *Jan.*, 1945.—A study is made of the breaking strength and elongation of several cords, varying as regards gauge, construction and variety of cotton. Experimental results are reported concerning the stretching treatments which involve various combinations of tension, heat and moisture. All treatments increase the strength of the cords, the greatest increase being obtained when the cord is stretched in a swollen condition in the presence of heat. A dual-stretching method is described which permits control of the elongation at 10 lb., independently of the strength.   L. S. G.

539.379 : 539.26 *see Abstr.* 1984

539.38   **2000**

The distortion of the Boussinesq field due to a circular hole. BARJANSKY, A. *Quart. Appl. Math.*, 2, *pp.* 16–30, *April*, 1944.—Jeffery's method (using bipolar co-ordinates) for solving the biharmonic equation $\nabla^4\Phi = 0$ is used. Starting with the stress function ϕ of the undistorted Boussinesq field, an auxiliary stress function χ is found such that $\Phi = \phi + \chi$ satisfies $\nabla^4\Phi = 0$ and all the boundary conditions arising in the problem of distortion when there is a circular hole. The stresses and strains in the discontinuous field may be determined from the derivatives of Φ. In an appendix the Boussinesq stress function is decomposed into a Fourier Series.   L. S. G.

539.38   **2001**

Stresses in the diaphragms of diaphragm-pumps. BINNIE, A. M. *Quart. Appl. Math.*, 2, *pp.* 37–42, *April*, 1944.—The diaphragm pump is briefly described. An approx. method of calculating the stresses in the diaphragm is explained and this is useful in designing the pump. The deflection of the diaphragm is assumed to be (i) sinusoidal, (ii) cubic, or (iii) following a Bessel function relation. Only those stresses are calculated which arise from distortion into the same shape as the chamber of the pump; no attention is paid to the local stresses round the ports.   L. S. G.

539.38   **2002**

Effect of a small hole on the stresses in a uniformly loaded plate. GREENSPAN, M. *Quart. Appl. Math.*, 2, *pp.* 60–71, *April*, 1944.—Exact expressions are derived for the distribution of stress in a large uniformly loaded plate having a single ovaloid hole. An ovaloid is a square with a semi-circle erected on each of two opposite sides and its equation may be expressed in the form

$$x = p \cos \beta + r \cos 3\beta, \quad y = q \sin \beta - r \sin 3\beta$$

for a suitable choice of p, q and r. The orthogonal curvilinear co-ordinate system used is obtained by taking real and imaginary parts of each side of $z = e^w + abe^{-w} + ac^3e^{-3w}$. The stress function is given exactly when the shape of the hole is that given above. This shape may become almost a square for suitable p, q and r. Some graphical results are given showing the stress distribution.   L. S. G.

539.38 : 678   **2003**

Speed of retraction of rubber. STAMBAUGH, R. B., ROHNER, M., AND GEHMAN, S. D. *J. Appl. Phys*, 15, *pp.* 740–748, *Nov.*, 1944.—A method of measuring the speed of retraction is described. It utilizes an electronic timing circuit with photocell input. Measurements of the speed of retraction of Hevea and synthetic rubbers as a function of elongation, temperature, carbon black loading and cure, are given. The nature of the retraction is discussed and high-speed photographs are given showing the manner in which rubber retracts.   L. S. G.

539.382 : 676   **2004**

Stress/strain curves of paper. GIBBON, E. R. *Paper Maker*, 108, *pp.* 53–56TS, *Dec.*, 1944.— Stretch/load (S/L) curves for a large variety of papers are shown. They were obtained by measuring the stretch when 1×108 in. hanging strips were loaded at the bottom ends. The curves are all similar in shape and fit the expression $S = F(L^2 + 5L)$ moderately well, F being a const. determining the slope. The recovery curves are approx. inversions of the stretching curves. Rayon film behaves entirely differently. The results indicate that the forces involved are independent of the furnish of the paper and of the paper machine conditions. Since successive loadings and unloadings of the same strip produce curves almost shadowing one another, with a negligible increase in permanent set, it is concluded that in the primary stressing the fibres slip over one another into positions of higher density, and that there is little or no extension of the actual fibres; however, once permanent set attains a max., the paper behaves towards tension as an almost elastic body.   J. G.

539.382.2 : 620.172.2   **2005**

The stress distribution at the neck of a tension specimen. BRIDGMAN, P. W. *Prepr. Amer. Soc. Met.*, *Oct.*, 1943.—[Abstr. 1402 B (1945)].

539.384 : 539.385 *see Abstr.* 2006

539.385 : 539.384   **2006**

A strain energy derivation of the torsional-flexural buckling loads of straight columns of thin-walled open sections. HOFF, N. J. *Quart. Appl. Math.*, 1, *pp.* 341–345, *Jan.*, 1944.—The loads, which were previously derived through an integration of the differential equations of the problem, are here determined by

means of the Rayleigh–Ritz–Timoshenko method. The columns are of a type used in Al alloy aircraft.

L. S. G.

539.387.4 2007

On the theory of bending of elastic plates. REISSNER, E. *J. Math. Phys.*, 23, *pp.* 184–191, *Nov.*, 1944.— The thin plate is considered and a system of 6th-order differential equations are established for the linear problem of bending. The results obtained by using these coincide with those of the classical theory except for narrow edge zones. It is necessary and possible to satisfy 3 boundary conditions along the edge of the plate, although the classical theory leads to only 2 boundary conditions. The connection with the theory of moderately thick plates is considered briefly.

L. S. G.

539.388.24 : 517.947.4 : 517.564 *see Abstr.* 1621

539.4 : 539.214 *see Abstr.* 1971

539.4.015 : 678 2008

Theory of filler reinforcement. GUTH, E. *J. Appl. Phys.*, 16, *pp.* 20–25, *Jan.*, 1945.—Ellipsoidal (including plate- and rod-like) filler particles, e.g. colloidal carbon black, is considered as suspended in a continuous rubber matrix. Various properties of the suspension are computed in terms of the properties of the matrix and the fillers. Viscosity, Young's modulus, stress-strain curve below crystallization, and permittivity of the suspension are found as functions of the volume concentration. These functions are linear for small loadings, in which case the tensile strength first decreases because of the stress concentration around the carbon black spheres when the samples are stretched and then increases for greater loadings because of the tendency of the carbon black spheres to form chains and, finally, a network. Stiffness increases with loading up to the point where the suspension becomes a dilution of carbon black by rubber.

L. S. G.

539.4.015 : 678 2009

Theory of filler reinforcement. DEWEY, J. M. *J. Appl. Phys.*, 16, *p.* 55, *Jan.*, 1945.—It is pointed out that results recently obtained by Rehner [Abstr. 937 (1944)] are inconsistent with the assumptions on which they are based. An alternative mathematical treatment is given of the stresses in the neighbourhood of a spherical filler particle in rubber.

L. S. G.

539.4.019 2010

Reactivity of cellulose pulps. JAYME, G. *Cellulosechem.*, 21, *pp.* 73–84, 1943.—The tensile strength of a cellulose pulp is determined principally by its lignin content, degree of polymerization, and hemicellulose content. The heat generated and the time to reach a max. temperature when a mixture of acetic and sulphuric acids and acetic anhydride acts on the pulp under standard conditions are measures of the reactivity of the pulp, and a guide to its behaviour when used for the manufacture of cellulose acetate.

J. G.

539.4.019 : 677 *see Abstr.* 2076

539.42.016.271 : 621.787 2011

Mechanical and metallurgical advantages of shot-peening. HORGER, O. J. *Iron Age, pp.* 40–49 *and* 100, *March* 29, *and pp.* 66–76, 146 *et seq., April* 5, 1945.— [Abstr. 1708 B (1945)].

539.43.016.27 2012

Shot peening and the fatigue of metals. MOORE, H. F. *Iron Age, pp.* 67–71 *and* 136, *Nov.* 2, 1944.— Shot peening, denoting the subjection of the surface of metal parts to a rain of metallic shot, produces a shallow surface layer of metal which is harder, stronger and less ductile than it was in the pre-peened state. In analysing what shot peening can accomplish in lengthening fatigue life of metal components, the author reviews the limitations of the process in offsetting various forms of structural damage. M.-V.

539.434 : 678 : 620.1.05 : 539.32 *see Abstr.* 1991

539.531 2013

Relative mechanical corrosion hardness of synthetic corundum. EPPLER, W. F. *Industr. Diamond Rev.*, 5, *pp.* 121–125, *June*, 1945.—Relative mechanical corrosion hardness (RMC hardness) is defined as the reciprocal of the volume loss in c.c. sustained during abrasion by sand blast, and, in the tests described a check was made after each second test with a standard control piece of synthetic corundum to ascertain whether there was blunting of the abrasive grains and wear of the nozzle hole. The hardness value of synthetic corundum boules subjected to blast attack parallel to the *c*-axis was about 30% higher than in a direction normal to it. The RMC hardness was not affected by tempering the corundum at 800°C. for 12 hr. The RMC hardness of other minerals was found to increase irregularly with Mohs' scale. The results obtained, and a comparison with rebound hardness, indicate that the modulus of elasticity of a test-piece may be of decisive importance in its relative mechanical corrosion hardness.

A. C. W.

539.61 : 532.69 *see Abstr.* 1722

539.893 : 539.31 *see Abstr.* 1990

541.123 : 535.336.2 : 539.155.2 *see Abstr.* 1937

541.123.28 : 536.423.15 *see Abstr.* 1801

541.123.3 : 532.77 *see Abstr.* 1730

541.123.3 : 535.324.2 : 532.739.2 *see Abstr.* 1729

541.123.3 : 536.423.15 *see Abstr.* 1802

541.124 2014

The mechanism of the diazo-coupling, reaction. IV. The decomposition of diazotized aniline at different *p*H values. HODGSON, H. H., AND MARSDEN, E. *J. Soc. Dy. Col., Bradford*, 61, *pp.* 20–21, *Jan.*, 1945.— The data [Abstr. 2267 (1944)] are now supplemented and supported by further experimental evidence obtained from a study of the decomposition of diazotized aniline at the approx. *p*H values $10 \cdot 5$, $8 \cdot 8$, $6 \cdot 7$, $5 \cdot 3$, $5 \cdot 2$ and $4 \cdot 2$, obtained by the presence of an excess of a metallic hydroxide which took the place of the $CaCO_3$ in the former experiments.

541.124.3 : 536.468 *see Abstr.* 1805

541.128 2015

Electron microscope studies of catalysts. TURKEVICH, J. *Proc. Electron Microscop. Soc. Amer., Chicago, Nov.*, 1944. *Abstr. in J. Appl. Phys.*, 16, *p.* 263, *April*, 1945.

541.13 : 541.182.6 2016

Electrochemical properties of silicic acid sols. MUKHERJEE, J. N., AND CHATTERJEE, B. *Nature, Lond.*, 155, *pp.* 85–86, *Jan.* 20, 1945.

541.132   2017

Effect of hydrogen ion concentration on cation exchange in clay salts. MUKHERJEE, J. N., AND MUKHERJEE, S. K. *Nature, Lond.*, 155, p. 49, *Jan.* 13, 1945.

541.132.3 : 620.193.92   2018

Galvanic corrosion of soil waters. PHELPS, H. S., AND KAHN, F. *Trans. Amer. Inst. Elect. Engrs*, 64, pp. 156–159, *April*, 1945.—[Abstr. 1422 B (1945)].

541.133.1 : 621.385.833   2019

Ion-migration phenomena observed with the electron microscope. THIELSCH, H. *J. Chem. Phys.*, 13, pp. 249–250, *June*, 1945.

541.138.2 : 620.193.27   2020

Anomalous inactivation of heavy metal anti-fouling paints. YOUNG, G. H., AND SEAGREN, G. W. *Nature, Lond.*, 155, pp. 715–717, *June* 16, 1945.—[Abstr. 1421 B (1945)].

541.139 : 538.69 *see Abstr.* 1919

541.144 : 677.31 = 3   2021

Dyeing properties of wool which has been exposed to light. ROESTI, H. *Melliand Textilber.*, 24, pp. 316–321, *July*, 1943.—Wool gabardine which has been washed and exposed to sunlight for 2 summer months, under glass, in absence of impure air, loses H_2S owing to decomposition of the cystine in the wool molecule. On boiling with H_2O there is evidence of further reactions between the resulting decomposition products and other reactive constituents of keratin. The normal amphoteric character of the wool is displaced to the acid side, and the acid binding capacity of exposed wool is some 13% less than that of the unexposed wool; this is reflected in its reduced affinity for the fixation of many acid equalizing dyes. The dyeing capacity and fastness to washing depend on the chemical nature of the dye, its particle size (or its degree of aggregation in solution), the swelling capacity of the wool (which is raised by exposure) and the chemical changes which occur in the wool.

J. G.

541.145 : 541.182.5 : 532.13 *see Abstr.* 1701

541.18.041.2 : 662.62 : 532.69 *see Abstr.* 1723

·541.18.051   2022

A pigment dispersion method for electron microscopy. O'BRIEN, H. C., JR. *Proc. Electron Microscop. Soc. Amer., Chicago, Nov.*, 1944. *Abstr. in J. Appl. Phys.*, 16, p. 263, *April*, 1945.

541.18.051   2023

Techniques useful with pigmented rubber cements. WILLISFORD, L. H. *Proc. Electron Microscop. Soc. Amer., Chicago, Nov.*, 1944. *Abstr. in J. Appl. Phys.*, 16, p. 263, *April*, 1945.—Uniformly good results can be obtained by dipping the supporting film into dilute suspensions. In case a specimen has a non-uniform appearance and interpretation proves difficult, it is helpful to photograph adjacent fields and to match the enlargements to form a consecutive series or panorama view.

541.182.5 : 535.515 : 537.29 *see Abstr.* 1834

541.182.5 : 541.145 : 532.13 *see Abstr.* 1701

541.182.6 : 536.666 *see Abstr.* 1813

541.182.6 : 541.13 *see Abstr.* 2016

541.183 : 531.19 *see Abstr.* 1685

541.183 : 539.216.1 : 532.72 *see Abstr.* 1727

541.183.1 : 535.6   2024

Adsorption colorimetry as an analytical technique. YUDKIN, J. *Nature, Lond.*, 155, p. 50, *Jan.* 13, 1945.

541.183.1 : 548.7 : 531.19 *see Abstr.* 1686

541.183.65 : 539.17 *see Abstr.* 1960

541.24 : 532.133 *see Abstr.* 1706

541.24 : 532.712 : 532.133 *see Abstr.* 1705

541.57 : 537.228.1 *see Abstr.* 1832

541.57 : 539.133 *see Abstr.* 1924, 1925

541.6 : 532.14 : 536.423.1 : 535.324 *see Abstr.* 1761

543.717 : 677   2025

The moisture relations of textiles. A survey of the literature. CARLENE, P. W. *J. Soc. Dy. Col.*, Bradford, 60, pp. 232–237, *Sept.*, 1944.—The results of the more important investigations into the hygroscopicity of textiles are collected. Fifty-six references are given to researches on the moisture absorption of cotton, and on cotton, rayons, wool, silk, jute and nylon. The absorption-desorption isotherms of raw and purified cottons are sigmoid in shape and indicate a hysteresis effect. Rayons give isotherms of similar form to those of cotton, but with appreciably higher regain at any particular humidity, the highest hygroscopicity being shown by cellulose nitrate rayon. Isotherms for different varieties of wool show that their absorptive capacities are very similar, and that the range of humidity over which wool must be conditioned to pass from the boundary absorption to the boundary desorption curve is independent of regain and is about 18%. The curves for silk are sigmoid, showing that silk is analogous in behaviour to wool and cotton; a saturation value of 35·8% regain was deduced from density and swelling data. Both jute and nylon give sigmoid curves, but the hygroscopicity of nylon is very low compared with that of the natural textile fibres. The influence of moisture on the physical characteristics of textile fibres and the effect of processing upon the moisture absorbency account for 15 references.   H. H. HO.

544.6 : 545.82 : 535.32 *see Abstr.* 1760

545.82 : 544.6 : 535.32 *see Abstr.* 1760

545.828 : 535.338.1 *see Abstr.* 1766

545.828 : 669.3 : 535.338.1 *see Abstr.* 1767

547.96 : 577.16 : 535.33–31 *see Abstr.* 1763

548.0 : 537.228.1 *see Abstr.* 1833

548.0 : 538.21 *see Abstr.* 1896

548.0 : 538.22 *see Abstr.* 1901

548.55 : 537.531 *see Abstr.* 1852

548.55 : 548.73 = 3 *see Abstr.* 2027

548.7 : 541.183.1 : 531.19 *see Abstr.* 1686

548.73   2026

X-ray measurement of order in the alloy Cu_3Au. WILCHINSKY, Z. W. *J. Appl. Phys.*, 15, pp. 806–812, *Dec.*, 1944.—A diffraction theory is developed for the evaluation of long- and short-range order in Cu_3Au and experiments are described for measuring each type of order. An expression is found for the long-range order parameter, S, and the amount of short-range order is specified by a set of parameters $\sigma_i (i = 1, 2, 3, \ldots)$ associated with the interatomic distances r_i. Theoretical values for σ_i are found.

Experimental results for long-range order were obtained by the aid of a Debye–Scherrer type vacuum camera of radius 4·45 cm., fitted with a small electric furnace so that the samples could be maintained at elevated temperatures during exposures. The values of S were found to be 0·86, 0·81, 0·79 for 250°C., 370°C. and 380°C., respectively. At the critical temperature of 388°C., S suddenly drops to zero and short-range order exists above this temperature. The dominant parameter σ_1, referring to nearest neighbours, was evaluated as 0·50 and 0·25 for 540°C. and 750°C., respectively.   L. S. G.

548.73 : 548.55 = 3   2027

The ruled surfaces of the space lattice interferences and their most important plane sections as single-crystal diagram curves. SEEMANN, H. *Z. Phys.*, 119, 5–6, *pp.* 374–396, 1942.—The geometrical properties of the surfaces and their plane sections are discussed. Among the latter the lemniscate receives special attention. The paper is a continuation of a series of earlier works [Abstr. 1555 (1931)]. The physical significance of the surfaces is discussed.   L. S. G.

548.73 : 548.74 *see Abstr.* 2030

548.74   2028

Chemical electron microscopy. PHELPS, R. T., LANGER, A. L., AND GULBRANSEN, E. A. *Proc. Electron Microscop. Soc. Amer., Chicago, Nov.,* 1944. *Abstr. in J. Appl. Phys.,* 16, *p.* 263, *April,* 1945.—The several variables which are important in the production of reproducible crystal forms for electron microscopy are briefly discussed. A method is described for preparation of small crystals which can be observed in the electron microscope. A scheme for systematic chemical analysis of some metal cations of one-component systems is presented.

548.74   2029

Crystal interference phenomena in electron microscope images. HEIDENREICH, R. D., AND STURKEY, L. *Proc. Electron Microscop. Soc. Amer., Chicago, Nov.,* 1944. *Abstr. in J. Appl. Phys.,* 16, *p.* 265, *April,* 1945.—The observation of electron reflections is reviewed. The observations of the reflected beams with the objective limiting diaphragm removed and the determination of the planes responsible for the reflections by this means are described. The results of the dynamical theory of electron diffraction are briefly discussed and the values of the characteristic crystal thickness D_0 are computed. These values are compared with the experimental values and are in agreement for the MgO (200) reflections at 60, 96, and 103 kV, MgO (220) reflections, and CdO (200) reflections at 60 kV.

548.74 : 548.73   2030

Correlation of MgO particle size determination by electron microscope and X-ray diffraction. BIRKS, L. S., AND FRIEDMAN, H. *Proc. Electron Microscop. Soc. Amer., Chicago, Nov.,* 1944. *Abstr. in J. Appl. Phys.,* 16, *p.* 266, *April,* 1945.—By varying the heating periods and temperatures, it was possible to produce particle sizes from 40–100 Å. Microscope magnifications obtained from an optically calibrated grating replica were accurate to ±5%. An X-ray Geiger counter spectrometer was employed to measure the shape of the diffraction lines of the MgO powder samples. The widths at half-maximum were measured

with an accuracy of $\pm \frac{1}{2}'$ of arc in 2θ. The particle size determinations by the two methods agreed to ±10% for the range 100–1 000 Å.

549.214 : 621.314.632 : 537.311.33 *see Abstr.* 1836

550.341   2031

The use of differences of arrival-times of P as an aid to epicentral determinations in the South Pacific. JONES, W. M. *N.Z. J. Sci. Tech. B,* 26, *pp.* 146–154, *Nov.,* 1944.—Curves have been drawn, covering the more important seismic portions of the South Pacific, showing the differences in P-arrival times between Wellington and Brisbane, and between Wellington and Suva, Seismological Observatories, for a normal and for a deep-focus earthquake, according to Jeffreys and Bullen's 1940 Tables. Other curves show the distances from these observatories to points over the same area. The plotting is on a Mercator projection. The use of such curves in determination of epicentres is briefly discussed. The effects of focal depth are illustrated by diagrams which show the magnitude and direction of the displacement of epicentres when normal focus is assumed for a deep-focus earthquake, and two methods are indicated by which a good approximation to an epicentre can be found directly from the P-arrival times at 4 or more stations, without making any assumption of focal depth.   C. J. G.

550.383 : 550.838   2032

Geophysical investigation of the Puhipuhi mercury deposit. MODRINIAK, N. *N.Z. J. Sci. Tech. B,* 26, *pp.* 61–65, *Sept.,* 1944.—A magnetic survey of the Puhipuhi plateau outlined the irregular thickness of the basalt sheet; the distribution of vertical magnetic intensity shows in first approximation the surface relief of the greywacke covered by the basalt. The close connection of loss of magnetic properties in basalt to thermal activity was shown. The instrument used was the vertical magnetic balance of Schmidt design.   C. J. G.

550.384   2033

Magnetic declination in New Zealand for epoch 1943–5. BAIRD, H. F. *N.Z. J. Sci. Tech. B,* 25, *pp.* 175–178, *Jan.,* 1944.—Preliminary maps of magnetic declination in New Zealand derived from the present survey are delineated for epoch 1943–5, based on computations made from 109 points recently occupied. Throughout the length of the Dominion, marked differences exist in the rate of secular variation, and fairly frequent re-occupation of suitable stations is necessary. The general trend of Farr's 1903–5 isogonals has been confirmed, but serious errors arise if they are amended merely by extrapolating the amount of secular variation applicable to, and previously known only at, Christchurch.   C. J. G.

550.422 : 539.16.08   2034

Radioactivity of New Zealand soils and rocks. MARSDEN, E., AND WATSON-MUNRO, C. *N.Z. J. Sci. Tech. B,* 26, *pp.* 99–114, *Nov.,* 1944.—Measurements of the α-ray activity of various soils in rocks in New Zealand, Australia and Great Britain are recorded and the methods and apparatus described. Analysis of the results shows that soil radioactivities are dependent upon the rocks from which they are derived rather than the type of soil. Basalts, andesites, rhyolites, and limestones gave low readings, while

granites and greywackes gave high readings of α-ray activities in ionization currents × 10^{18}/cm.^{2} These results were confirmed in the case of greywackes and basalts by observations with the γ-ray chamber. The γ-ray activity of K salts in the samples considerably influenced the results. The measurements were originally carried out to determine whether emanations and radiations from regional soils and rocks have a positive influence on the incidence of goitre. Although the results indicate a degree of correlation between radioactivity and the incidence of goitre, there is insufficient evidence that this correlation arises from causation; it may be that both are related to some common related factor.

C. J. G.

551.838 : 550.383 *see Abstr.* 2032

551.501.7 : 551.547 *see Abstr.* 2039

551.508.21 : 551.521.13   2035
The stability of the silver-disk pyrheliometer. CHAUDET, E. *Bull. Amer. Met. Soc.*, 25, *pp.* 189–195, *May*, 1944.—Using 18 000 determinations of the solar radiation made by a single observer with a single silver-disk pyrheliometer, together with a series of comparisons with similar instruments, the reduction const. of the instrument is found to be stable to within 1% over a period of 30 yr. There is some evidence that small variations betw. different instruments are due to differences in the length of vestibule.   A. HU.

551.508.77   2036
On the measurement and frequency of traces of precipitation. NEUBERGER, H. *Bull. Amer. Met. Soc.*, 25, *pp.* 183–188, *May*, 1944.—A device is described in which rain or snow, even if falling in less than "measurable" quantities, imprints itself on the smoked surface of a paper belt moved slowly under a slot in the cover of the instrument by a synchronous motor. A modification of the instrument automatically exposes a 1 × 2 in. smoked plate every hour. The surfaces are slightly heated from underneath to prevent the recording of fog and dew. The effect of introducing trace recorders at a station where previously only subjective records were made is illustrated.   A. HU.

551.510.535 : 621.396.11 : 551.594.6   2037
A theoretical survey of the possibilities of determining the distribution of the free-electrons in the upper atmosphere. RYDBECK, O. E. H. *Trans. Chalmers Univ. Tech. Gothenburg*, *No.* 3, 74 *pp.*, 1942.—The propagation and dispersion of an electromagnetic wave packet in the ionosphere is treated by the "eiconal" method of geometrical optics. Examples of the actual dispersion of down-coming wave-trains are shown. Under most conditions the dispersion is not serious and the determination of the time of travel is fairly accurate. But a reduction of the wave equation to the "eiconal" equation is only possible when the relative change of the refractive index within a wavelength is very small. When this is not the case a closer approx. to the actual wave solution is given by the Brillouin–Wentzel–Kramers method which leads to the phase relations and the virtual path length. These are used in determining the electron and collision frequency distributions. When the time of travel is known as a function of the wave frequency it is possible to determine the distribution

of the free electrons over most of the lower part of the ionized layers. The mathematical methods used for this purpose are discussed thoroughly and accurate solutions may be obtained at places where the magnetic inclination is either great or small. The variation of the collision frequency with height may be determined from sweep frequency reflection coefficient measurements if the electron density distribution is determined at the same time. The necessary measuring equipment is fairly complicated but the prospects of getting valuable results are good. A number of ionospheric records are examined and it is shown that the electron density distribution is parabolic over a wide density range. An integration is made of the total number of electrons in several cases and it is shown that this number may decrease even though the max. electron density increases (e.g. in the afternoon in equatorial regions). This strongly supports the various hypotheses of the expansion of the upper atmosphere. The exact wave functions for a parabolic layer (involving Weber's parabolic cylinder functions) are studied briefly and it is shown that the travel time and the dispersion are finite at the critical frequency and that the reflection coefficient differs widely from the classical one only when the layer thickness becomes less than about 4 wavelengths.   L. S. G.

551.515.3   2038
The structure of a waterspout. JOHNSON, N. K. *Quart. J. Roy. Met. Soc.*, 70, *pp.* 127–128, *April*, 1944.—Two photographs of a waterspout are reproduced and tentative explanations of some striking features are advanced.   A. HU.

551.521.13 : 551.508.21 *see Abstr.* 2035

551.547 : 551.501.7   2039
Construction of 10 000 ft. pressure charts over ocean areas. NAMIAS, J. *Bull. Amer. Met. Soc.*, 25, *pp.* 175–182, *May*, 1944.—Two methods of constructing upper-air isobars over the sea are described, one for use where surface observations are many, as in peace time, the other suitable for war time, where only a few ship observations and possibly a few radiosonde observations are available. In the first method, sea-level isotherms and isobars are used to compute pressures at 10 000 ft. by assuming the saturated adiabatic lapse rate. In the second method the departures from normal of air temperature at selected points are estimated from the air-mass structure on the sea-level chart and the probable air temperatures calculated. Hypothetical surface temperatures obtained by working backwards from radiosonde observations are conformed to in the process. Thence the procedure is that of the first method. The effect of departures from the assumed lapse rate is discussed, and a practical example given of the second method.   A. HU.

551.576.4   2040
Cloud heights by solar observation. DECKER, F. W. *Bull. Amer. Met. Soc.*, 25, *pp.* 197–201, *May*, 1944.— An optical method is given for finding the height of middle and high clouds. If Δt is the difference in time betw. sunrise (or sunset) at the surface and at the cloud level at the observer's zenith, z the zenith angle and α the solar altitude angle, it is shown that $\alpha = \Delta t \, dz/dt$. Curves are given for the evaluation of dz/dt for any date at any latitude, and for the deter-

mination of the cloud height from α. The method is particularly suitable when the shadow of the horizon is cast on scattered cirrus. A. HU.

551.594.12 : 537.56 *see Abstr.* 1870

551.594.2 2041
Electric fields below clouds. CHALMERS, J. A. *Quart. J. Roy. Met. Soc.*, 70, *pp.* 121–127, *April,* 1944.—The large fields below clouds calculated from Wilson's theory of the space charge of ions produced by point discharge are in total disagreement with the small fields recorded by the alti-electrograph. The author extends his previous work [Abstr. 2471 (1939)] and shows that the discrepancy cannot be removed by considering the action either of charged raindrops or of vertical air currents in decreasing the space charge. A. HU.

551.594.221 : 634.972 : 621.317.331 = 4 2042
Electrical resistances of trees and their susceptibility to lightning. SZPOR, S. *Rec. trav. sci. Polonais internés en Suisse*, 2, 48 *pp.*, 1944.—[Abstr. 1568 B (1945)].

551.594.25 2043
On Wilson's theory of the collection of charge by falling drops. WHIPPLE, F. J. W., AND CHALMERS, J. A. *Quart. J. Roy. Met. Soc.*, 70, *pp.* 103–118, *April,* 1944.—Wilson's theory of selective absorption of ions by drops of water falling in an electric field is developed mathematically in some detail, and trajectories are drawn for ions of different signs and velocities relative to the drop. The effect of turbulent flow is to modify the stream-line theory in some cases, the rate of charging being affected more than the final charge. The results obtained are in good agreement with such experimental work as has been carried out. The application to the production of thundercloud fields is complicated by the low conductivity produced by ion absorption on cloud particles, but tentative calculations show that the process may be of importance in the charging of raindrops below the cloud. A. HU.

551.594.6 : 621.396.11 : 551.510.535 *see Abstr.* 2037

553.621 2044
Quartz crystal in New Zealand. HENDERSON, J. *N.Z.J. Sci. Tech. B*, 25, *pp.* 162–169, *Jan.,* 1944.—The properties and uses of quartz crystal are briefly described and the little known of their occurrence in New Zealand is indicated, South Westland and Takaka being the districts where rock crystals suitable for piezo-electrical purposes are found. In the former, well-faceted crystals the development of prism and pyramid faces suggest uniform molecular structure, line fractures and partings in metamorphic and sub-metamorphic rocks. The crystals are commonly in clusters, and, as masses of interlocked inseparable crystals are useless, only the freely projecting larger individuals have value. At Takaka, irregular pieces of lumped quartz are found in gravels near a mass of granite on the west side of the lower valley. These seem to have been derived from the highly-quartzose veins of pegmatite, the last product of crystallization of the magma, that occur in the granite, and probably also in the adjacent rocks. Crystal faces of any kind are rare, but any piece large enough to yield plates 1 in. square free from fractures, inclusion bubbles or other flaws, is worth collecting.

The few tests so far made suggest that each lump of quartz is a fragment of a single crystal. The structural axes and twinning characteristics of fragments can be determined by optical means alone. C. J. G.

576.8.094 2045
An unfamiliar pattern of bacteria morphology. SMITH, W. E., AND MUDD, S. *Proc. Electron Microscop. Soc. Amer., Chicago, Nov.* 1944. *Abstr. in J. Appl. Phys.*, 16, *p.* 265, *April,* 1945.—Bacteroides funduliformis presents a pattern of morphological change which differs markedly from that of ordinary bacteria. This deviation has led to completely unorthodox interpretations concerning the reproduction of this form. Electron microscopic studies give promise of resolving the issues in a way that ordinary microscopy could not have done.

576.851 2046
Observations of bulges on acetobacter. GRAY, C. H., MARTON, L., AND TATIUN, E. L. *Proc. Electron Microscop. Soc. Amer., Chicago, Nov.*, 1944. *Abstr. in J. Appl. Phys.*, 16, *p.* 265, *April,* 1945.—Electron microscope observations of different mutants of acetobacter, produced by X-ray irradiation, show a very great number of cells in different stages of division. Common to the different mutants is the presence of 1 or 2 darker areas of about 100 mμ in dia. in each cell. This darker area, interpreted as high concentrations of nucleo-protein, is composed of bulges above the level of the main body of the cell.

576.858 2047
Types of morphology found in bacterial viruses. ANDERSON, T. F., DELBRUCK, M., AND DEMEREC, M. *Proc. Electron Microscop. Soc. Amer., Chicago, Nov.*, 1944. *Abstr. in J. Appl. Phys.*, 16, *p.* 264, *April,* 1945.—Five different viruses active on *E. coli* B have been identified using the electron microscope. Of these γT_4, and T_6 which belong to the same serological group have the complex structure of γ-phage with oval heads, 60×80 mμ, containing a characteristic internal structure and having well-defined tails. The virus T_5 has a structure very similar to that of a previously described staphylococcus virus with a round head 100 mμ in dia. and an easily distinguished tail. The virus α, in a third serological group, has a dense head about 50 mμ in dia. and a faint tail. Members of a fourth serological group have been studied, but the virus particles have not been identified.

576.858 : 578.636 2048
On the artifacts produced by the use of distilled water as an intermediate medium in the mounting of bacterial specimens for the electron microscope. HILLIER, J., AND KURKJIAN, A. *Proc. Electron Microscop. Soc. Amer., Chicago, Nov.*, 1944. *Abstr. in J. Appl. Phys.*, 16, *p.* 264, *April,* 1945.—A study is made of the appearance in the electron microscope of *E. coli* which have remained in distilled water for increasing periods of time after removal from a young growing culture. The appearance is compared with that observed in bacteria prepared quickly from a culture of corresponding age.

576.858 : 578.636 2049
Electron microscopy of some animal viruses. SHARP, D. G., TAYLOR, S. R., McLEAN, I. W., JR., BEARD, D., AND BEARD, J. W. *Proc. Electron Micro-*

scop. Soc. Amer., Chicago, Nov., 1944. *Abstr. in J. Appl. Phys.*, 16, *p.* 264, *April*, 1945.—The influence of impurities on electron micrographs of influenza virus was studied by adding various substances to purified virus preparations which regularly give pictures showing little foreign matter. Animal viruses are usually prepared in buffers or in balanced saline solutions (0·16 *M*). Electron micrographs can be made on these preparations without dialysis or washing of prepared films, but sometimes fields without salt crystals are difficult to find. When $CaCl_2$ ($\frac{1}{4}$ to 1%) is used, much of this difficulty disappears, and in the case of equine encephalomyelitis and influenza viruses the particles are greatly increased in contrast. More uniform particle distribution is obtained, and excess $CaCl_2$ can be removed from the collodion film by washing until optimum contrast is obtained for demonstration of internal structure. Increased contrast has not been found with rabbit papilloma virus nor with tobacco mosaic virus.

576.858.9　　　　　　　　　　　　　　　　　　　2050

Observations on the structure of pyocyaneus bacteriophage. Schultz, E. W., Thomassen, P. R., and Marton, L. *Proc. Electron Microscop. Soc. Amer., Chicago, Nov.*, 1944. *Abstr. in J. Appl. Phys.*, 16, *p.* 265, *April*, 1945.—The head appears to be pentagonally shaped and to contain a filament structure, the form suggesting the letter W. There are indications that its true projected shape approaches a distorted figure 8, the latter consisting of straight lines linked by short sharply curved portions. The tail is attached to the middle of one of the straight sections, from where it may go off at different angles. The high density of the filaments suggests that they may possibly be composed of a distinctive nucleo-protein surrounded by a medium of lower density. Partial orientation of the heads of the 'phage particles may be interpreted as due to preferential settling out of the 'phage from its medium on to a flat surface. Such surfaces may result from shrinkage of the less dense portions of the protoplasm around the more rigid, skeleton-like filament.

577.16 : 547.96 : 535.33-31 *see Abstr.* 1763

577.16A : 539.17 *see Abstr.* 1961

578.087 : 531.787 *see Abstr.* 1699

578.6　　　　　　　　　　　　　　　　　　　　　2051

Availability of electron micrograph for instruction in microbiology. Morton, H. E. *Proc. Electron Microscop. Soc. Amer., Chicago, Nov.*, 1944. *Abstr. in J. Appl. Phys.*, 16, *p.* 265, *April*, 1945.—The function of the Committee on Materials for Visual Instruction in Microbiology is to make available to teachers of microbiology, public health, or preventive medicine, the various motion-picture films, photographs, and electron micrographs prepared by research workers which might be useful aids in the visual instruction of the above mentioned subjects.

578.636 : 576.858 *see Abstr.* 2048, 2049

591.111　　　　　　　　　　　　　　　　　　　2052

On the theory of blood-tissue exchanges. II. Applications. Smith, R. E., and Morales, M. F. *Bull. Math. Biophys.*, 6, *pp.* 133–139, *Dec.*, 1944.—An application is made of a theory of inert gas absorption given previously [Abstr. 735 (1945)]. Uptake curves are

interpreted and the method of obtaining tissue constants from such curves is discussed. Experimental results are given and there is a review of previous analytic treatments of the subject.　　　　L. S. G.

591.111　　　　　　　　　　　　　　　　　　　2053

On the theory of blood-tissue exchanges. III. Circulation and inert-gas exchanges at the lung with special reference to saturation. Morales, M. F., and Smith, R. E. *Bull. Math. Biophys.*, 6, *pp.* 141–152, *Dec.*, 1944.—The uptake of inert gases by the lungs is analysed and it is shown that the gas transfer governs the early stages of gas uptake by a body region so that the latter may conceivably be used as an index of lung function. The Fick-principle, which serves as a basis of most indirect cardiac output methods, is an approx. to a more general equation. When the latter is applied to a slowly permeating gas, it offers the possibility of determining functional lung surface. [See Abstr. 2052 (1945)].　　　　L. S. G.

591.112　　　　　　　　　　　　　　　　　　　2054

A problem in the mathematical biophysics of blood circulation. I. Rashevsky, N. *Bull. Math. Biophys.*, 7, *pp.* 25–33, *March*, 1945.—An approx. method is applied to the problem of flow of an incompressible viscous fluid in an elastic distensible tube. It is shown that the tube wall may execute damped transverse harmonic oscillations due to the flow and that the viscosity contributes only a damping factor. It is suggested that the work may have some application to the vibrations of the walls of blood vessels.　　L. S. G.

591.112　　　　　　　　　　　　　　　　　　　2055

A problem in the mathematical biophysics of blood circulation. II. Relation between pressure and flow of a viscous fluid in an elastic distensible tube. Rashevsky, N. *Bull. Math. Biophys.*, 7, *pp.* 35–39, *March*, 1945.—A continuation of a previous paper [Abstr. 2054 (1945)]. The viscous flow produces a pressure drop along the line of flow and this causes a variation of the radius of the tube along the axis. An approx. formula is deduced for this radius as a function of the distance along the axis, and a formula is obtained connecting the pressure drop and total flow. For very high rates of flow, the pressure drop does not vary linearly with the flow, but more rapidly.　　L. S. G.

591.134　　　　　　　　　　　　　　　　　　　2056

Some nutritional and excretional interactions and the growth of an organ or colony. Morales, M. F., and Kreutzer, F. L. *Bull. Math. Biophys.*, 7, *pp.* 15–24, *March*, 1945.—The differential equation of growth of a bounded cell community (e.g. an organ) equipped with a food supply and a waste removal mechanism is derived and integrated. The integral form and an empirical curve lead to values for the vital coefficients of the equation. Changes to be expected in these coefficients and analytic methods for estimating these are discussed. The theory set forth may, with the aid of experimental data, help in elucidating the general nature of population growth.

　　　　　　　　　　　　　　　　　　　　　　L. S. G.

591.148 : 535.247.4 *see Abstr.* 1757

591.175.4　　　　　　　　　　　　　　　　　　2057

Muscular dynamics and muscular efficiency. I. The isometric length-tension diagram of striated skeletal muscle. Householder, A. S. *Bull. Math. Biophys.*, 7, *pp.* 5–13, *March*, 1945.—The diagram for individual

fibres and for the whole muscle is considered and it is proposed that the tension p may be represented for a muscle whose fibres are parallel and not in series, in the form $p = f(x) + \beta\phi(\alpha, l, x)$, where the form of ϕ is known and is independent of the muscle. Here x is the length, β is the degree of activity of the muscle and α and l are parameters determined by experiment. L. S. G.

591.181 2058

The two-factor theory of nervous excitation with non-normal accommodation. HOUSHOLDER, A. S. *Bull. Math. Biophys.*, 6, *pp.* 157–161, *Dec.*, 1944.— A parameter is introduced for use when the accommodation is non-normal and the resulting modified theory is discussed, especially in the case of nerve excitation by alternating current. Non-normality has the effect of lowering the optimal amplitude of the a.c., measured in units of the observed rheobase.
L. S. G.

591.185.5 : 534.321.9 *see Abstr.* 1745

591.86 : 537.533.72 2059

Structure of certain muscle fibrils as revealed by the use of electron stains. HALL, C. E., JAKUS, M. A., AND SCHMITT, F. O. *Proc. Electron Microscop. Soc. Amer.*, *Chicago, Nov.*, 1944. *Abstr. in J. Appl. Phys.*, 16, *p.* 263, *April*, 1945.

608.4 : 539.37 2060

A note on the representation by model systems of the behaviour under stress of rubber-like materials. BILMES, L. *J. Sci. Instrum.*, 22, *pp.* 16–17, *Jan.*, 1945.

612.84 : 535.7 *see Abstr.* 1778

612.84 : 535.733.1 *see Abstr.* 1782

613.48 : 667.16 : 677 = 3 2061

Properties and testing of woollen articles containing "zellwolle," which have been treated for water resistance. STADLER, J., AND HARTMARK, B. *Melliand Textilber.*, 24, *pp.* 311–313, *July*, 1943.—The usual tests of the physical properties of these materials may give misleading indications of their quality and behaviour in practice. Comparisons between articles made from "zellwolle"-wool mixtures before and after impregnation with Kaurit KF, Ramasit KGT conc., or Persistol NO, showed that on wetting and hydro-extraction, most H_2O is obtained from the impregnated cloth. The rate of drying is the same for both when the H_2O is uniformly distributed; when it is not, the treated cloth dries the slower. On treatment by the Bundesmann "rain test" less H_2O is absorbed by the treated cloth; on then shaking the articles and allowing them to dry, H_2O is lost much more rapidly from the untreated cloth. The more rapid removal of moisture from a wet untreated cloth produces a cooling effect, which aids the skin respiration of the wearer; from this point of view therefore, impregnation, which closes the pores of the cloth, is a disadvantage. J. G.

615.84 : 518.5 *see Abstr.* 1637

616.314 : 537.533.72 *see Abstr.* 1857a

62 : 378 *see Abstr.* 1603

624.13 : 531.224.8 2062

Extension of the wedge theory of earth pressure. DANIEL, A. W. T. *Engineering*, 158, *pp.* 341–343, *Nov.* 3, 1944.—The wedge theory of earth pressure against a retaining wall agrees with experiment when the material is dry sand. The general problem is investigated in which the retained earth has a variable slope as in river banks. Several cases are considered, and, in the case in which two planes of rupture occur, the solution of the problem has been greatly simplified. G. E. A.

631.4 : 539.21 *see Abstr.* 1969

658.3 2063

On time losses in machinery undergoing interruptions. KRONIG, R. *Physica*, *'s Grav.*, 10, *pp.* 215–224, *April*, 1943.—A situation is considered where a number of continuously working machines (e.g. looms or spinning machines) suffer interruptions at irregular intervals. There is an economic optimum for the number of machines to be placed under the supervision of one workman for repairs, and this optimum is determined in the present paper. The problem is similar to one occurring in telephone systems and a comparison is made of the two situations. L. S. G.

658.3 2064

On time losses in machinery undergoing interruptions. II. KRONIG, R., AND MONDRIA, H. *Physica*, *'s Grav.*, 10, *pp.* 331–336, *May*, 1943.—A method is given for computing the average time of awaiting repair for machines suffering interruptions when one workman is in charge of a given number of machines. The method is algebraic and makes considerable use of the properties of determinants. L. S. G.

663.632.4 2065

Selective calcium softening for industrial water supplies. SHEEN, R. T., AND WOODRUFF, E. B. *Industr. Engng Chem.*, 36, *pp.* 971–979, *Nov.*, 1944.— Many industrial water requirements can be satisfied by softening the raw water to reduce the Ca hardness only and leave the Mg hardness in solution. This is particularly applicable to process water used for cooling purposes, and where reduction of Ca hardness and alkalinity will establish a balanced water that will not deposit $CaCO_3$ on heat-exchange surfaces with rise in temperature. The chemical cost of reducing Ca hardness is materially less than the cost of reducing both Ca and Mg hardness. Lime and soda softening for reduction of Ca hardness only can be controlled by pH value of the process; the pH is normally held between $9 \cdot 6$ and $10 \cdot 2$, and the exact control point is determined for the individual water. The softening process is followed by partial neutralization, either with acid or with scrubbed and purified flue gas to a controlled pH point.

666.11 : 532.137 *see Abstr.* 1708

666.23 2066

Synthetic sapphires. BROWN, K. W., CHIRNSIDE, R. C., DAUNCEY, L. A., AND ROOKSBY, H. P. *G.E.C. Jl* [*Gen. Elect. Co.*], 13, *pp.* 53–59, *Aug.*, 1944.—X-ray examination shows that synthetic sapphires, made by feeding Al_2O_3 powder slowly through an oxy-hydrogen flame, causing it to fuse and subsequently to crystallize, are single crystals of α-alumina. An historical summary is given of the methods used. A. E. T.

667.11 = 3 2067

Ce–Es process for bleaching goods containing cotton and mixtures of cotton and "zellwolle"; principles and practical operation. DEUSCHLE, G., KLING, W., AND SIMON, G. *Melliand Textilber.*, 24, *pp.* 21–26, *Jan.*, 1943.—The Ce–Es method involves the following

sequence of treatments: wetting out; alkaline chlorination; controlled peroxide bleaching; washing. Advantages claimed as compared with the classical methods are, a lower loss in weight on bleaching, more selective removal of substances (especially proteins) responsible for low colours, and preservation of the morphological structural elements of which the fibre is built. Layouts for bleaching in the web and piece are described.   J. G.

667.11 = 3   2068

Improving fibres by bleaching. BAIER, H., AND HUNDT, W. *Melliand Textilber.*, 24, pp. 73–79, *Feb.*, 1943.—It is highly desirable to wash fibres prior to bleaching (e.g. to remove residues from synthetic fibres which may affect the bleaching process catalytically); 0.1% H_2SO_4 for 30 min. at 20°, calgon, and/or aq. NaOH or Na_2CO_3 are used, according to circumstances. The optimum bleaching conditions for the peroxide and hypochlorite methods are outlined. The course and effects on the goods of the bleaching process are controlled by titrations to methyl orange and phenolphthalein and by cuprammonium viscosity measurements, respectively. Combinations of the above bleaching methods are unsuitable for rayon and "zellwolle," as they result in a reduction in strength.   J. G.

667.16 = 3   2069

On the sizing of acetate silk with linseed emulsions. SAUER, E., AND GELDMACHER, G. *Kolloid Z.*, 100, pp. 425–435, *Sept.*, 1942.—Linseed emulsions with softeners, animal or vegetable colloids, oils, fats or waxes, were used for sizing lustrous or matt acetate silk. pH value, viscosity coefficient of dispersion and stability of the emulsion were determined. Strength and elongation, size and water content, and the distribution of size over the cross-section of the fibre were investigated on sized strands. No deterioration in sized fibres was observed after 7 months. Gelatine and soft soap were the most efficient softeners.   R. N.

667.16 = 3   2070

Seven questions concerning impregnation. MECHEELS, O. *Melliand Textilber.*, 24, pp. 26–32, *Jan.*, 1943.—Comparisons are made between wool fabric before and after treatment with a paraffin wax emulsion. Testing methods are briefly described. Max. evaporation of sweat from the skin of the wearer occurs in dry weather, and both impregnated and untreated cloth behave similarly in this respect. Rain, however, tends to seal the outer surface, and to an extent which is greater for the untreated cloth, and evaporation of sweat is thus retarded by approx. 10%. Mechanical methods of cleaning do not affect the properties of treated cloth; if chemical cleaning methods are used, reimpregnation is necessary. No difference is detectable between the cloths in resistance to scouring; but when "zellwolle" is used, impregnation increases this resistance.   J. G.

667.16 = 3   2071

On the paper "On limiting concentrations of rubber poisons in rubberizing processes," by P. Kluckow. KEHREN. *Melliand Textilber.*, 24, pp. 85–86, *Feb.*, 1943.—With rayon to be used for rubberizing in the manufacture of waterproof, the Cu and Mn contents are of special importance, and although Mn is seldom

found in serious quantities, the Cu + Mn content should not exceed 0.002–0.005%, particularly if a mixture of natural and artificial rubbers is used. Co, Cr, Fe, and fatty acids have either not been found in rayon in appreciable quantities, or their effects as rubber poisons when present in relatively small conc. have not been fully substantiated. There is evidence, however, that substances other than the above may also act as poisons, but the nature of these has as yet not been ascertained.   J. G.

667.16 : 677 : 613.48 = 3 *see Abstr.* 2061

667.2 : 675.6 = 3   2072

Use of covering colours for the improvement of animal skins. GINZEL, A. *Melliand Textilber.*, 24, pp. 87–88, *Feb.*, 1943.—Various shades may be imparted to animal skins by applying (with a pistol-type spray, at 25–30°) solutions of logwood, fustic, sumac, root extracts, or of PbO in boiling NaOH to which is added the appropriate quantity of S to produce shades ranging from yellow to black. Ordinary aniline dyes are less suitable, as they have a poor affinity for skins and are relatively fugitive. Vat dyes (indigo) are better, and excellent results are obtainable with dyes which are oxidized, after application, with air or chemical reagents (H_2O_2). With the latter, a greater range of deeper shades results, the depth and tone of which are more easily controlled, and the hair has an improved lustre; they can often be applied by padding. Sealskin effects on dog or musk pelts are obtainable with blacks of the Ursol type which are applied in presence of Cu, V, Ce or Fe catalysts and developed with aq. $KClO_3$ and finished with an alkaline Cr solution; glycerin is used to improve handle. Special details are given for obtaining nutria, otter and beaver effects.   J. G.

667.211 : 677.31 : 535.683.1 = 3 *see Abstr.* 1777

667.3 = 3   2073

"Orema" dyes, a new class of dyes for textile printing. KRÄHENBÜHL, E. *Melliand Textilber.*, 24, pp. 315–316, *July*, 1943.—These dyes have no specific affinity for individual fibres but are applied in presence of an H_2O-oil emulsion, and fixed by heating at 100–200°. They are very finely divided pigments, made into stable pastes, which do not settle out in 1 day after dilution with H_2O. They are resistant to washing, light (fastness value 6–8), and for 10 min. in boiling aq. 1% NaOH, and they give clear bright printing effects; 24 shades are listed and, if carragheen moss is added, slop padding methods may be used. The fixing agent is a yellow-green, gelatinous, weakly-acidic solid, which can be diluted with H_2O; it contains a volatile organic solvent which is removed during the heating stage. Under some circumstances the printed cloth develops a harsh handle, which is corrected by mechanical treatment.   J. G.

667.3 : 677.46 = 3 *see Abstr.* 2078

669 : 535.33 *see Abstr.* 1762

669.22 : 539.219.1 *see Abstr.* 1979

669.3 : 545.828 : 535.338.1 *see Abstr.* 1767

675.6 : 667.2 = 3 *see Abstr.* 2072

676 : 539.382 *see Abstr.* 2004

676.1   2074

Barking wood with water. SHAW, E. C. *Pulp Pap.*

Mag. Can., 45, *pp.* 896–898, *Nov.*, 1944.—A method of removing bark from pulp wood by jets of water under 650 lb./in.^{2} pressure is described. Advantages are that all dirt is also removed, and there is less chance of producing "broomed" ends which also retain dirt. The logs are simultaneously rotated and moved forward by means of 2 rolls revolving in the same direction at different speeds, one being fluted and the other having a buttress-type screw thread. J. G.

676.1 2075

Indirect *v.* direct sulphite cooking. EDWARDES, V. P. *Pulp. Pap. Mag. Can.*, 45, *pp.* 891–892, *Nov.*, 1944.—Advantages of indirect cooking are freedom from dilution by condensed steam, and improved acid penetration due to the steaming of the chips while the temperature is rising slowly. Proper chip distribution is very important with the indirect method; they should lay flat and be distributed uniformly across the width of the digester. With the installation described (forced circulation through outside heaters) there resulted (compared with a standard direct cook) an appreciable increase in production for the same cooking time, a 35% reduction in the consumption of cooking steam, a marked reduction in tailings, a more uniformly cooked pulp, improved strength and colour, a 5% increase in yield, a slight decrease in the S and limestone used, and an increase in the conc. of the waste liquors. J. G.

676.1 : 532.133 *see Abstr.* 1707

676.2 : 532.694.1 *see Abstr.* 1725

676.2 : 539.217.3 *see Abstr.* 1977

676.4 : 539.217.5 *see Abstr.* 1978

677 : 539.211 = 3 *see Abstr.* 1970

677 : 539.216.1 = 3 *see Abstr.* 1976

677 : 539.4.019 2076

The effects of temperature and humidity on the physical properties of tire cords. DILLON, J. H., AND PRETTYMAN, I. B. *J. Appl. Phys.*, 16, *pp.* 159–172, *March*, 1945.—An apparatus is described by means of which tire cords may be conditioned and tested at elevated humidities (1·6–65% R.H.) and temperatures (20–165°C.); it consists of a portable conditioning unit which is used with a standard tensile testing machine. Equipment for measuring creep of tire cords under dead load at elevated temperatures is also described. Five types of cord were used, viz. medium stretch and low stretch cotton, viscose rayon, Fortisan and Nylon. "10 pound-stretch," and ultimate stretch were studied as functions of relative humidity, temperature, and moisture regain. It is shown that the tensile properties are best represented as functions of temperature at constant regain. The creep data are analysed in terms of two arbitrarily defined indices, "initial compliance" and "weighted creep." Both the tensile and creep characteristics are discussed from the viewpoint of current theories of structure and also in the light of their relations to serviceability in tires. H. H. HO.

677 : 543.717 *see Abstr.* 2025

677 : 667.16 : 613.48 *see Abstr.* 2061

677.05 : 531.1 *see Abstr.* 1684

677.12 = 3 2077

Cottonization of bast fibres. HALLER. *Melliand*

Textilber., 24, *pp.* 6–8, *Jan.*, 1943.—In the improved (patented) method described, hemp fibres are treated with aq. NaOH at 80°–90°, then washed well and treated with aq. $KMnO_4$; MnO_2 is thus deposited in the middle lamella of the fibre. The material is washed and treated with Na hypochlorite in acetic acid at 20°–30°. The MnO_2 catalyses the localized liberation of Cl_2, which disintegrates the fibrous structure mechanically without damaging it. The mass is then washed and treated successively with aq. Na bisulphite and NaOH. Good results are obtained in admixture with 70% of cotton and/or "zellwolle." J. G.

677.2 : 539.216.1 : 539.264 = 3 *see Abstr.* 1985

677.31 : 541.144 = 3 *see Abstr.* 2021

677.31 : 667.211 : 535.683.1 = 3 *see Abstr.* 1777

677.46 : 667.3 = 3 2078

Film printing of viscose rayon with acid dyes. FRANZOSO, R. *Melliand Textilber.*, 24, *pp.* 313–314, *July*, 1943.—The film printing of viscose rayon may be used for the same class of work as the "rouleaux" process, but it gives purer tones and brighter contrasts. Where fastness to washing and light are important the Indanthrene, Rapidogen and Indigisol dyes may be used. Acid dyes are less suitable because of their poorer affinity and fastness, but the affinity is improved by the use of a printing mix containing Mg oxide. After printing the goods are steam-damped for 1 hr., and finished. Fastness is improved by the use of urea-formaldehyde plastics or by fixation with urea; there are indications that the "animalizing" of viscose rayons by treatment with N or S compounds improves their affinities for film printed acid dyes. J. G.

677.47 : 532.13 *see Abstr.* 1703

678 : 531.39 *see Abstr.* 1690

678 : 536.653 : 536.73 *see Abstr.* 1816

678 : 536.7 *see Abstr.* 1815

678 : 539.32 *see Abstr.* 1992, 1993

678 : 539.38. *see Abstr.* 2003

678 : 539.4.015 *see Abstr.* 2008, 2009

678 : 620.1.05 : 639.434 : 539.32 *see Abstr.* 1991

678.7 2079

Lactoprene, new synthetic rubber. FISHER, C. H., MAST, W. C., REHBERG, C. E., AND SMITH, L. T. *Industr. Engng Chem.*, 36, *pp.* 1033–1035, *Nov.*, 1944.—Acrylic ester copolymers containing vulcanizable unsaturation were prepared by polymerizing methyl acrylate or ethyl acrylate with small quantities of polyfunctional monomers, such as butadiene, isoprene, and allyl maleate. Compounding the soft copolymers with S and accelerators, followed by curing, produced rubbery vulcanizates. Several abundant carbohydrates can be converted, through lactic acid as an intermediate, into approx. an equal weight of vulcanized acrylic resins.

678.7 : 539.32 *see Abstr.* 1994, 1995

679.5 : 535.826 *see Abstr.* 1787

679.5 : 536.42 = 3 *see Abstr.* 1798

771.3 : 621.383 2080

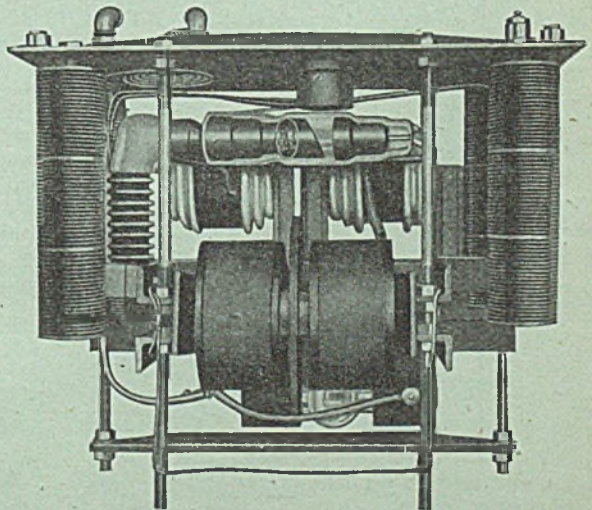Photo-electric flash camera. *Electronic Engng*, 17, *p.* 280, *Dec.*, 1944.