

# ABSTRACTS OF THE PHYSICO-CHEMICAL LITERATURE IN JAPAN

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## 1—GENERAL AND PHYSICAL CHEMISTRY

**Further investigation on single crystals of metaboric acid.** H. Tazaki. *J. Sci. Hiroshima Univ.*, **10**, 109—112 (1940). — In this expt. single crystals of  $\text{HBO}_2$  ( $\alpha$ ) for microscopic obsn. could be produced very easily, and the acicular  $\text{HBO}_2$  ( $\alpha$ ) crystals grown in the direction of  $[110]$  were obsd. An easy method of producing single crystals of  $\text{HBO}_2$  ( $\beta$ ) was devised. Author.

**Dimorphic transition of metaboric acid under heat.** H. Tazaki. *J. Sci. Hiroshima Univ.*, **10**, 114—116 (1940). — In this expt., it was obsd. that  $\text{HBO}_2$  ( $\alpha$ ) crystals were immediately converted into  $\text{HBO}_2$  ( $\beta$ ) crystals under heating, and the thermodynamic conclusion was confirmed exptly. Author.

**Possibility of measuring the thermal conductivity of gases by Wilson chamber.** T. Takeuti. *Bull. Tokyo Univ. Eng.*, **9**, 186—187 (1940). — A possibility is shown mathematically that the thermal conductivity of gases can be measured by obsg. the vanishing point of drops due to expansion of the chamber. Author.

**The electric conductivity and thermionic emission of the oxide cathode.** E. Nishibori and H. Kawamura. *Proc. Phys.-Math. Soc. Japan*, **III**, **22**, 378—384 (1940). — The work function of electron emission from the oxide cathode is the sum of the work  $V$  which is required for conduction electrons to escape from the solid, and an approximate half of the energy difference  $E$

between conduction band and impurity level. This impurity level is caused by alkaline earth atoms, which are dispersed excessively in the oxide and can be produced by the "activation" of the cathode. When the population of the impurity level increases with metal atoms by this activation, the number of conduction electrons increases resulting in the good conductivity as the general property of impurity semi-conductor. The authors measured the electric conductivity simultaneously with the thermoelectronic emission by the "Sonde" of Ni wire inserted in the oxide layer, and found that both increased simultaneously by the activation. Thus they confirmed that the thermoelectrons are the conduction electrons thermally emitted. Also the thermionic work function  $\phi$ ,  $E/2$ , and  $V$  were measured by the temp. dependence of the emission and conductivity. And it was found that  $V$  does not vary with the activation in spite of the variation of  $\phi$  and  $E$  in wide range (0.4eV). The value of  $V$  is 0.25eV in the commonly used cathode. In the activated cathode the values of  $\phi$  and  $E$  were 1.05eV and 1.6eV resp. Authors.

**Studies on the photoconductivity of semi-conducting layers composed of some heavy metal sulphide or selenide.** I. The relation between the spectral sensitivity and the light absorption in the photoconducting layer composed of cadmium selenide, and the microscopic examinations of its structure in relation to its photoconductivity. T. Asai.

*Bull. Inst. Phys. Chem. Research*, 19, 1-3 (1940).—The author measured the spectral sensitivity and the light absorption of the Cd-Se photoconducting layer, and found that the max. of spectral sensitivity lies somewhat displaced towards the longer wave-length than that of the corresponding absorption band. Besides, by microscopic examns. a close relation was obsd. between the growth of crystal grains that constitute the layer and its photoconductivity.

**II. Microscopic examinations of the semi-conducting layer composed mainly of thalious sulphide in relation to its photoconductivity.** *ibid.*, 19, 4-5 (1940).—By microscopic obsns. of the Tl-S semi-conducting layer, the author confirmed that the more the size of its crystal grains enlarges, the more its sensitivity increases with simultaneous decrease of the dark-resistance. The cause of this relation is considered in the present paper. Author.

**The temperature change of the electric resistance of the hydrated crystals.** H. Saegusa and T. Matumoto. *Sci. Repts. Tôhoku Imp. Univ.*, I, 28, 235-244 (1939).—The change of the electric conductivities of  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ,  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ,  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ ,  $\text{KCr}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$  and  $\text{K}_4\text{Fe}(\text{CN})_6 \cdot 3\text{H}_2\text{O}$  for temp. was examd. The conductivity is increased with the rise of temp.; when dehydrated it is markedly decreased; when thoroughly dehydrated the value is smaller than that for the hydrated and it changes according to  $\log \sigma = B + (A/T)$  except in the case of  $\text{KCr}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$ . J. C. L.

**The change of the electric resistance of  $\text{Cu}_2\text{Cl}_2$  solutions at low temperatures.** T. Mizoguti. *J. Electrochem. Assoc. Japan*, 8, 41-43 (1940).—The copper electrode was immersed in a highly concd. hydrochloric acid soln. to which ethyl alcohol, methyl alcohol, glycerine and ethylene-glycol were added either singly or together, and the change of the electric resistance was measured at  $-80$ — $30^\circ$ . It was found that the temp.

coeff. becomes larger with the fall of temp. Accordingly, low temp. can be measured electrically with the soln. in question.

J. C. L.

**Study on the heat absorption of some insulating materials.** S. Shimizu, T. Inai and I. Nishifuji. *J. Inst. Elec. Eng. Japan*, 60, 263-264 (1940).—Temp. rise of some insulating materials has often its origin in the absorption of heat radiation. Absorptive power of a material is a function of temp. though it is const. in the temp. range  $20$ — $30^\circ$  C and proportional to its emissive power. The absorptive power is, therefore, estimated by measuring the emissive power. The emissive power has been indirectly detd., by Koch and Mossow, from the loss when the radiator heated at approximate  $100^\circ\text{C}$  approached a specimen at ordinary temp. In the present measurement, the emissive power was calcd. from the temp. drop of thermo-pile in place of compensating the loss with Joule's heat. Fibre is of the greatest absorptive power having the value 96.5%; and phenol resin, ebonite, etc. follow it. Cryptomeria is of the least value, 90.1%, with glass, bakelite, etc. next to it. Authors.

**Studies on oxidised and polymerised oils. III. Association phenomena from viscosity measurement.** M. Tanimari. *J. Soc. Chem. Ind. Japan*, 43, 386-387 (1940).—Linseed oil was oxidised and polymerised so far as the iodine values of the products decreased to 158, 140 and 124, and the viscosities were measured at  $30^\circ$ ,  $50^\circ$ ,  $70^\circ$  and  $90^\circ\text{C}$  resp. Between the viscosity and temp. there is an approximate relation,  $\log \eta = B/T - A$ , where  $B$  is a const. relating to the energy of molecular force. The association degree ( $f$ ) was calcd. from the ratio  $\eta$  by  $\eta'$  in the case where  $\eta$  is the viscosity of the oil and  $\eta'$  is that of the ideal liquid of the same oil, estimated from the dilute benzene soln. of the oil, in which the effect of molecular force of the solvent is considered to be negligibly small. Between  $f$  and  $B$

there holds the following relation,  $\log f = aB + b$ , and there is no distinct difference between the oxidised and the polymerised linseed oils. Author.

#### Refractive indices of cellulose fibre.

III—IV. S. Okajima and T. Iwamoto. *J. Soc. Chem. Ind. Japan*, 43, 351—357 (1940). — The relation between  $n_{\parallel}$ ,  $n_{\perp}$  and  $v$  of the hydrate cellulose fibre is calcd. by using O. Kratky's plastic deformation formulas I and II (*Kolloid-Z.*, 87, 299 (1939)) and the results previously obtained by the authors (cf. Reports I and II, *J. Soc. Chem. Ind. Japan*, 40, 795 (1937)). By eliminating  $v$  from the results an approximately linear relation as given below is found for both the cases of the plastic elongation:

$$n_{\parallel} = n_{iso} + \frac{n'_{\tau} - n_{iso}}{n_{iso} - n'_{\alpha}} (n_{iso} - n_{\perp})$$

The authors think that this formula also governs the change performed under more general deformation mechs. other than O. Kratky's. In the above formula  $n_{\parallel}$  and  $n_{\perp}$  are the refractive indices of fibre for the light passing normal to the fibre axis, parallel and normal to which it is polarising planely and  $v$  is the plastic elongation given to the isotropic fibre which has the refractive index  $n_{iso}$ ,  $n'_{\tau}$  and  $n'_{\alpha}$  are the refractive indices of cellulose micell (cf. Reports I and II). Two series of samples were prepd. The wet isotropic fibre of hydrate cellulose was elongated under the const. loads of various amts. and dried under tension. The isotropic nitrocellulose fibre was elongated to various extents in 96% alcohol and then denitrated and dried, keeping always their lengths unchanged.  $n_{\parallel}$  and  $n_{\perp}$  of the samples were measured by Becke's method which gives the results: (1) The change of  $n_{\parallel}$  and  $n_{\perp}$  against  $v$  of both series is governed approximately by O. Kratky's deformation mechs. I and II resp. (2)  $n_{\parallel}$  and  $n_{\perp}$  for both series are represented with the line obtained in the above calcn. Authors.

**Silicon monoxide.** H. Inuzuka. *Mazda Kenkyu Jiho*, 15, 161—166 (1940). —

Silicon monoxide is prepd. by reduction of silica with carbon in the vacuum electric furnace. It is very fine powder having dark orange colour and burns slowly in air without flame, forming silicon dioxide. Its temp. of ignition is about 950°C and specific gravity is 2.2 at room temp. Refractive indices of the material are from 1.70 to 1.80 and it shows an isotropic character under a polarizing microscope. This range of refractive indices is perhaps due to disorder of atomic arrangement. Its crystalline structure is studied by X-ray and electron diffraction. Author.

#### Some physico-chemical properties of

ammonium sulphophosphate,  $(NH_4)_2H_3SO_4PO_4$ . S. Uno. *J. Soc. Chem. Ind. Japan*, 43, 475—478 (1940). — The pure ammonium sulphophosphate crystal,  $(NH_4)_2H_3SO_4PO_4$ , was prepd. from ammonium sulphate and phosphoric acid, and some physico-chem. properties of this double salt were investigated. (i) Ammonium sulphophosphate is colourless crystals of density 1.780. (ii) The aqu. soln. of this salt is acidic, the  $pH$ -value of 0.1 M soln. being 1.71. (iii) The author obtained the following empirical formula for the vapour press. of the satd. soln. at 15°—40°C:  $\log p(\text{mm}) = -\frac{2131}{T} + 8.3718$ . (iv) The solubilities in g per 100 g of water, detd. at 0°—100°C, may be well expressed by the following empirical formula:  $S = 106.69 + 1.3491t - 0.001095t^2 + 0.00025395t^3$ . (v)  $(NH_4)_2H_3SO_4PO_4$  is monoclinic, (100) planes being elongated parallel to the c axis. Author.

#### Liquefying pressure of butadiene gas.

R. Kitani and K. Ohmura. *Mazda Kenkyu Jiho*, 15, 72—74 (1940). — By compressing some purified butadiene gas prepd. by Aldol's method the liquefying press. is measured by the following method. The butadiene gas in a small cylindrical glass tube sealed at the one end having a definite volume is compressed by filling it with mercury from the open end and the volume changes measured through a telescope. From these changes  $P$ -

$V$  curves are plotted and the true liquefying press. of the gas calcd. They are resp. 12.5, 30.7, 51.5, 75.0, 100.0, 130.5, 169.0 cm Hg at the temps.  $0^\circ$ ,  $5^\circ$ ,  $10^\circ$ ,  $15^\circ$ ,  $20^\circ$ ,  $25^\circ$ ,  $30^\circ$  C, resp. The results coincide well with the data calcd. from Mishchenko's formula. As to the present practical purpose of liquefaction of butadiene gas, however, 20—30 mm of Hg press. must be added to each of these true liquefying presses. Authors.

**The pKc values of  $\gamma$ -dinitrophenol at varying concentrations of NaCl.** K. Shinohara and A. Inaba. *Yakugaku*, 59, 432—439 (1939).—The pKc values of  $\gamma$ -dinitrophenol (Kahlbaum) was detd. by means of the Gillespie type colorimeter. Acetate buffer containing varying amts. of NaCl was used. Its  $pH$  ( $= -\log a_{H_3O^+}$ ) values were calcd. by aid of an eq. reported by Larsson and Adell and checked exptly. NaCl (Kahlbaum) was employed after recrystallizing twice and subsequent heating at  $600^\circ$ . The pKc ( $= -\log a_{H_3O^+}$ ) value 5.315, was obtained by extrapolating pKc to  $\mu=0$  by aid of the Debye-Hückel eq. In comparison with  $\alpha$ -dinitrophenol this method is considered justifiable. Authors.

**Studies on solubilities. VI. Solvency of mixed solvents (3).** S. Miyake and S. Sugito. *Tech. Repts. Kyushu Imp. Univ.*, 15, 33—51 (1940).—The solubilities of cellulose acetate with 45—63% bound acetic acid in mixed solvents of ( $C_6H_5Cl + C_2H_5OH$ ), ( $C_6H_5Cl + CH_3OH$ ), ( $C_6H_5Cl + C_6H_6$ ), ( $CHCl_2 + C_2H_5OH$ ), ( $CHCl_2 + CH_3OH$ ), ( $CCl_4 + CH_3OH$ ) were measured at  $30^\circ$  C. The dielectric consts., densities, refractive index of ( $C_6H_5Cl + C_2H_5OH$ ), ( $C_6H_5Cl + CH_3OH$ ), ( $C_6H_5Cl + C_6H_6$ ), ( $C_2H_5OH + C_6H_6$ ), ( $CH_3OH + C_6H_6$ ) were measured at  $30^\circ$  C and the molecular polarization, the mass moment and the deviation of the molecular polarization were calcd. The relation between these values and the abnormal high solubilities in mixed solvents was examd. Authors.

**Studies on equilibrium of system  $NH_3-P_2O_5-SO_3-H_2O$ .** S. Uno. *J. Soc. Chem. Ind. Japan*, 43, 399—402 (1940).—I. The ternary systems  $(NH_4)_2SO_4-H_3PO_4-H_2O$  and  $(NH_4)_2SO_4-(NH_4)_2H_3SO_4PO_4-H_2O$ . From the solubility isotherms for the  $(NH_4)_2SO_4-H_3PO_4-H_2O$  system measured at  $25^\circ$  and  $70^\circ$  C, the formation of a double salt,  $(NH_4)_2H_3SO_4PO_4$ , was ascertained. The ternary system  $(NH_4)_2SO_4-(NH_4)_2H_3SO_4PO_4-H_2O$  was also studied at  $0^\circ-100^\circ$  C. II. The ternary system  $(NH_4)_2SO_4-NH_4H_2PO_4-H_2O$ . The isothermal diagrams for the ternary system  $(NH_4)_2SO_4-NH_4H_2PO_4-H_2O$  were detd. at  $0^\circ-100^\circ$  C: no formation of the double salt was obsd. in this system. III. The ternary system  $NH_4H_2PO_4-H_3PO_4-H_2O$  and the quaternary system  $NH_4H_2PO_4-(NH_4)_2H_3SO_4PO_4-H_3PO_4-H_2O$ . The author detd. the isothermal diagrams for the ternary system  $NH_4H_2PO_4-H_3PO_4-H_2O$  and quaternary system  $NH_4H_2PO_4-(NH_4)_2H_3SO_4PO_4-H_3PO_4-H_2O$  at  $25^\circ$  and  $70^\circ$  C resp. The data for the ternary system  $(NH_4)_2H_3SO_4PO_4-H_3PO_4-H_2O$  were recalcd. from those for the  $(NH_4)_2SO_4-H_3PO_4-H_2O$  system given in the previous Report I. Author.

**Viscosity effect on the rate of solution of calcium carbonate in hydrochloric acid.** H. Tominaga, H. Adzumi, and T. Isobe. *Bull. Chem. Soc. Japan*, 14, 348—352 (1939).—The viscosity effect on the rate of reaction between marble and hydrochloric acid was measured. The mech. of the reaction of the first order reaction is considered and it is shown that the true chem. reaction on the marble surface and the diffusion of the reactant and that of reaction products are concerned in this order. The same conclusion is obtained from the expts. of changing the rotational velocity of the marble disk. The apparent heat of activation, which was calcd. by Moelwyn-Hughes from the temp. coeff. of the rate, is corrected by considering the viscosity effect. Authors.

**The nuclear hydrogen exchange reaction of hydrochloric acid-aniline in**

an aqueous solution. I. Reactions in neutral and acidic solutions. M. Kozumi. *Bull. Chem. Soc. Japan*, 14, 530-539 (1939).—The velocity of the exchange reaction:  $C_6H_5NH_3Cl + H_2O = C_6H_5DNH_3Cl + H_2O$  was measured with 0-3N hydrochloric acid solns. at 100°C. Results: the concns. of hydrochloric acid and aniline (Sample: water 1.9:1-3.0:1) have no influence on the reaction velocity. The mech. of the

reaction is deduced to be  $C_6H_5NH_2 + H_2D^+O = C_6H_5DNH_2 + H_3^+O$ . J. C. L.

The kinetics of the reduction of ferric oxide. K. Kawakita. *This Journal*, 14, 79-85 (1940).

Note on the solubility of solid non-electrolytes. R. Negishi. *This Journal*, 14, 137-145 (1940).

## 2-ATOMIC STRUCTURE, RADIOCHEMISTRY AND PHOTOCHEMISTRY

On the gravitational perturbation for the Dirac electron. H. Yamamoto. *Mem. Coll. Sci. Kyoto Imp. Univ.*, A, 22, 225-235 (1939).—The author studied, by the generalized wave eqs. in the tensor forms, a quantum gravitational problem which might be reduced to a perturbation problem for the stationary state of the Dirac electron.

Author.

On the Sargent curves. S. Kojima. *Proc. Phys.-Math. Soc. Japan*, III, 22, 384-390 (1940).—Using the data obtained by the authors, the Sargent curves were plotted for the isotopes of atomic numbers between 29 and 33. The curves fit better to the Fermi's theory than K.U. The same results are also verified in the study of the Sargent curves for natural radioactive elements and for very light elements. A fact is pointed out that if the Sargent plots are made for all electron emitters without any restriction for their atomic numbers a very clear front is produced. From this it may be considered that the first Sargent curves for elements coincide with each other and that the product of the wave functions of the disintegrated proton in a nucleus and the emitted electron is independent of the atomic number.

Author.

Artificial radioactivity of chromi-

um. T. Amaki, T. Imori and A. Sugimoto. *Sci. Papers Inst. Phys. Chem. Research*, 37, 395-398 (1940).—Induced radioactivities of chromium were investigated by bombarding chromium with slow neutrons, fast neutrons, and fast deuterons. The existence of two radioactive isotopes of chromium is established:  $Cr^{55}$  (1.7 hours)  $Cr^{51}$  (about 14 days).

Authors.

Quantum-mechanical treatment of helium-hydride molecule ion  $HeH^+$ . S. Toh. *Proc. Phys.-Math. Soc. Japan*, III, 22, 119-126 (1940).—The wave functions for  $HeH^+$  were approximately expressed by a linear combination of suitable functions and from these the equil. internuclear distance, the zero point energy, and the dissocn. energy were found to be 1.346 A.U., 0.23eV (vibration frequency:  $3400\text{ cm}^{-1}$ ) and 1.28eV resp.

J. C. L.

A note on the scattering of neutrons. S. Kikuchi and T. Wakatuki. *Proc. Phys.-Math. Soc. Japan*, III, 22, 142-144 (1940).—In the scattering of fast neutrons by atoms, the fact that the predominance of the small angle scattering increases regularly with the increasing atomic number can be explained quite naturally by introducing 'nuclear form-factor' quite similar to the case of X-rays, in

which the predominance of small angle scattering over the Thomson factor is explained by 'atomic formfactor'. J. C. L.

**Neutron induced radioactivity in Columbiun (Niobium).** R. Sagane, S. Kojima, G. Miyamoto and M. Ikawa. *Proc. Phys.-Math. Soc. Japan*, III, 22, 174—182 (1940).—The radioactivities produced in Columbiun (Niobium) by slow and fast neutron bombardments were studied. The results obtained are as follows:

$\text{Cb}^{93} (n, \gamma) \text{Cb}^{94} 6.6 \pm 0.13 \text{ min. } (e^-) \text{ ---}$

$\text{Cb}^{93} (n, 2n) \text{Cb}^{92} 11 \pm 1 \text{ days. } (e^-)$   
 $1.38 \times 10^6 \text{ eV (K-U)}$

$\text{Cb}^{93} (n, \alpha) \text{Y}^{90} 66 \pm 2 \text{ hours. } (e^-)$   
 $2.11 \times 10^6 \text{ eV, } 0.90 \times 10^6 \text{ eV (K-U)}$

Chem. identification and cloud chamber study of the  $\beta$ -rays are made in  $\text{Cb}^{91}$  and  $\text{Y}^{90}$ , produced by the processes mentioned above. Arguments are given for the assignment to these isotopes. Authors.

**On the spin-orbit interaction between elementary particles and the angular asymmetry in the N-P scattering.** T. Miyazima. *Proc. Phys.-Math. Soc. Japan*, III, 22, 188—197 (1940).—The discovery of the quadrupole-moment of the deuteron shows that in its ground state the deuteron is not spherically symmetrical, but cigar-shaped. Therefore, the ground state of the deuteron can not be  ${}^3\text{S}$ ; it must be a state in which some higher state as  ${}^3\text{D}$  is coupled with  ${}^3\text{S}$ . This is just the fact required by the meson theory of nuclear force. But the potential derived from the meson theory is inconvenient, because it must be cut off at a certain distance from the origin in order that the binding energy of the deuteron calcd. from this potential may be finite. Flüggé thought that the potential derived from the meson theory was qualitatively correct, and presents a possible form of the potential which preserves main features of the theory and has no singularity at the origin. In this paper the author adopted Flüggé's type of potential, the radial part of which was taken as a square

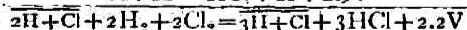
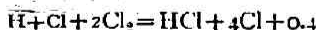
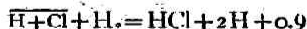
well with the range  $r_0$ , the classical electron radius, and the ground state of the deuteron was treated in the form of simultaneous eqs. between  ${}^3\text{S}$  and  ${}^3\text{D}$ . The solns. was obtained in series. The quadrupole-moment, the binding energy of the deuteron and the total cross-section of protons for thermal neutrons were used to det. a part of the consts. involved in the potential. It was found that, though  ${}^3\text{D}$  is mixed about 20% in the wave function of the deuteron in its ground state, it has little effect on the scattering of neutrons of 2—3 mev. by protons, and the difficulty of explaining the large angular asymmetry in the N-P scattering as was suggested by the expts. of Kikuti, Aoki and Wakatuki remains as before. Author.

**On the scattering of fast neutrons.** H. Aoki. *Proc. Phys.-Math. Soc. Japan*, III, 21, 232—250 (1939).—In Part I, the absorption-scattering cross sections of many elements for neutrons of different energy from about 2.1 to 2.8 mev are detd. Complicated dependences of the cross sections upon the neutron energy are obsd. The cross section of hydrogen is compared with theory. In Part II, the differential scattering cross section is detd. for H, C, Al, Fe and Pb at the mean scattering angle of about  $40^\circ$ . From the results, it is expected that the angular distribution of scattered neutrons is much different from isotropic one in cases of Al, Fe and Pb referred to the system of laboratory and in the case of H referred to the system in which the centre of gravity is at rest. The scattering by carbon is expected to be an isotropic one. Author.

**On the resonance capture of slow neutrons and emission of gamma-rays.** II. I. Nonaka. *Mazda Kenkyu Jiho*, 15, 129—131 (1940).—The method of investigating the resonance neutron groups of any nucleus, which is not made radioactive by neutron capture, by utilising the gamma-rays emitted in the capture process itself was extended to Cl, Co, Ag and Ba. The gamma-ray intensity was measured as a function of

thickness of paraffin layer interposed between a D+D neutron source and a detector. As the intensity of the gamma-rays emitted from these nuclei was very small except in the case of Ag, no such distinct results were obtained as in the case of Cd or of Hg, reported in the previous paper. But, from analysis of the gamma-ray intensity curves, it can be shown that Cl has not any distinct resonance groups. Co has a group of about  $10^1$ — $20^2$ eV in energy, and Ba has a group of very high energy (perhaps of the order of  $10^3$ eV). The result for Ag is in qualitative agreement with that obtained by the ordinary method of  $\beta$ -ray activity. In addition, the relative number of gamma-ray quanta emitted per capture of a thermal neutron was obtained to be 0.64, 0.74, 1.00 and 0.82 for Cl, Ag, Cd and Hg resp. And these results are compared with those of other investigators. Author.

**Spectroscopic study of chemical reaction of some gaseous bodies.** M. Miyajima. *Gakujitu Kyoho*, 15, 38—41 (1940).—In the present study hydrogen chloride molecules which are combined loosely and appear in the flame front in an explosive chem. reaction of chlorine and hydrogen are indicated by a notation  $\overline{\text{H+Cl}}$ . They become stable molecules HCl when they lose the vibrational energy by collision with hydrogen and chlorine molecules in the course of propagation of the flame front. The value 5.4 V of dissociation energy of HCl molecules is estimated, using the molecular consts. given by Jevons. Under this view the reactions are shown by the following eqs.



Thus the velocity of production of  $\overline{\text{H+Cl}}$  molecules is given by the eq.  $\frac{dn}{dt} = \frac{1}{2}n$ ;  $n$  being the number of  $\overline{\text{H+Cl}}$  molecules in the flame front at any instant. Some of these molecules, however, will be reduced by collision with the wall of reaction tube and HCl

molecules in the flame front. The eq.  $\frac{dn}{dt} = n(1/2 - a)$  is taken.  $a$  being a reducing factor. From this eq. we obtain  $n = n_0 e^{a(1/2 - a)t}$ ,  $n_0$  being the number of  $\overline{\text{H+Cl}}$  molecules at  $t=0$ . The reaction velocity will be also increased with number of collision i.e., with the square of gas press. in the tube. Thus the reaction velocity is expressed by the following eq.:  $\frac{dm}{dt} = kp^2n$ , where  $m$  is the mass of HCl produced,  $k$  a const. and  $p$  the press. of gases. Taking such a value of press. as increases with propagation of the flame front in the reaction tube, the following eq. is introduced from above eq.:  $m = \frac{1}{(h-i)^2} \{ \gamma - \beta(e^{kt} - 1) \}$ ,  $k = \frac{1}{2} - a$ , where  $\gamma$  and  $\beta$  are consts. An explosive chem. reaction will be given when  $\gamma - \beta(e^{kt} - 1) = 0$ . In the case of the reaction of bromine and hydrogen a similar result is obtained. Author.

**Absorption spectra of solid substances.** M. Kobayashi and R. Tsuchida. *J. Chem. Soc. Japan*, 60, 769—773 (1939).—Three methods are described for measuring the absorption spectra of various solid substances. The single-crystal method can be applied for considerably large transparent crystals. The microscopic and the reflection methods are for fine microscopic crystals and powder in amorphous state, resp. As examples of these methods, several substances have been measured such as  $\text{KCr}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$ ,  $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]_2\text{Cl}$ ,  $[\text{Co}(\text{NH}_3)_4(\text{CO}_3)]_2\text{Cl}$ ,  $[\text{Co}(\text{NH}_3)_4(\text{CO}_3)_2\text{NO}_3] \cdot 1/2\text{H}_2\text{O}$ ,  $[\text{Co}(\text{NH}_3)_4(\text{CO}_3)_2\text{SO}_4] \cdot 3\text{H}_2\text{O}$ , ZnS, CdS, HgS (Cinnabar), etc. Their absorption curves are given and the characteristic properties of absorption bands of solids are discussed from the view point of the coordination theory of valency. Authors.

**Absorption spectra of metallic complexes. VI. Absorption spectra of cobalti-, chromi-, nickel- and ferri-cyanide complexes.** H. Kuroya and R. Tsuchida. *J. Chem. Soc. Japan*, 61, 597—601 (1940).—Nearly all cobaltic complex salts are, as well

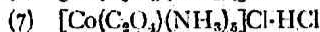
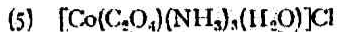
known, coloured, while cobalti-hexacyanide,  $K_2[Co(CN)_6]$ , is exceptionally almost colourless, only two selective absorption bands being hitherto found in the ultra-violet regions. The present authors regard them as the second and the third bands of the complex salt, considering its stereochem. and electronic configurations. In the present work, therefore, the first absorption band was sought for and was actually detected in the visible regions, at the wave-length of about  $417 m\mu$ . For comparison, the absorption spectra of  $K_3[Cr(CN)_6]$ ,  $K_3[Fe(CN)_6]$  and  $K_2[Ni(CN)_4]$  were studied, of which the former two are octahedral and the last is square. It was found that every member of them possesses, as anticipated, three absorption bands, namely the first, the second and the third. The authors claim, as the results of these expts., that the working hypotheses proposed by R. Tsuchida concerning the absorption bands of compds. have been confirmed here again. Authors.

**On the absorption spectra of polynuclear complex salts.** Y. Ohyagi. *Bull. Chem. Soc. Japan*, 15, 186-195 (1940).—Distinct absorption spectra of the polynuclear cobalt complex salts are obsd. in the phosphoric acid soln., in which the salts are stable.

Author.

**Researches on the concentration of hydrogen ions in the aqueous solutions of complex cobaltamines and their absorption spectra.** V. Aqueous solutions of complex salts containing oxalato-radical. F. Uemura and N. Hirasawa. *Bull. Chem. Soc. Japan*, 15, 161-166 (1940).—All the salts treated in the present paper contain the oxalato ( $C_2O_4$ ) radical in their complex nucleus. Expts. have been performed in the same manner as mentioned in previous publications. The samples which have been prepd. for study as follows:

- (1)  $[Co(C_2O_4)_3]K_3 \cdot H_2O$
- (2)  $[Co(C_2O_4)_2(H_2O)OH]K_2$
- (3)  $[Co(C_2O_4)_2(NH_3)_2]K \cdot H_2O$
- (4)  $[Co(C_2O_4)(NH_3)_2(NO_2)_2]K \cdot H_2O$



- (1) Out of the seven salts taken, the two samples, namely  $[Co(C_2O_4)_2(H_2O)OH]K_2$  and  $[Co(C_2O_4)(NH_3)_2]Cl \cdot HCl$  do not show any selective absorption in their ultra-violet regions.
- (2) The other five complex salts are not greatly influenced by the variation of hydrogen ion concn.
- (3) When the number of oxalato-radical is increased in the complex radical, the wave-length given by the center of max. absorption can be proved to be generally shifted to a longer wave length side.
- (4) When the center of max. absorption is recognised to have shifted, the absorbing power has become stronger.
- (5) The *pH*-values of aqu. solns. of complex salts are increased by the insertion of ammonia molecules in complex nucleus.

Authors.

**Absorption spectra of metallic complex salts of 2, 2'-Dipyridyl.** III. K. Yamasaki. *Bull. Chem. Soc. Japan*, 15, 130-136 (1940).—When a mixt. of an aqu. soln. of  $CoCl_2$  containing  $HCl$  and an alcoholic soln. of 2, 2'-Dipyridyl (Dip) is evaporated under  $H_2$ -Atmosphere, a blue compd.  $[CoCl_2] \cdot (H_2Dip)$  (I) and a green compd.  $CoDipCl_2$  (II) are obtained. I can be obtained also by mixing alcoholic soln. of Dip with alcoholic soln. of  $CoCl_2$  satd. with  $HCl$ . When heated at  $120^\circ$  I loses  $2HCl$  and gives a bluish green compd.  $CoDipCl_2$  (III), an isomer of I. I absorbs moisture from air and gives  $CoDipCl_2 \cdot H_2O$  (IV) and  $CoDipCl_2 \cdot 4H_2O$  (V). IV is red and V is rose coloured. When heated at  $100^\circ$  or in vacuum over  $P_2O_5$  the IV and V change into III. I, II, III, IV, and V give the same yellow aqu. soln. and this soln., when evaporated, always gives II. The absorption spectra of I, II, III, IV and V were studied in the solid state, in alcoholic and aqu. solns.

Author.

**Studies on hydrocarbon mixtures by the Raman effect.** III. H. Okazaki. *J. Chem. Soc. Japan*, 60, 1269-1274 (1939).



—Samples: (i) 2 kinds of petroleum (B. P. 68° and 68–69°) synthesized by the Fischer method using Co and Fe as catalysts; (ii) Pentane  $D_{4}^{20}$  0.6221; (iii) Hexane  $D_{4}^{20}$  0.6695; (iv) Octane  $D_{4}^{20}$  0.7297. (ii) and (iii) were isolated from Kahlbaum's petroleum and (iv) from Fraenkel and Landau's. Results: (i) Both kinds do not differ essentially, their constituents being normal paraffins. (ii) it is found that a large quantity of isopentane is contd. rather than normal pentane. (iii) The chief constituent is normal hexane, and methylcyclopentane and a trace of cyclohexane are also contd. (iv) The appearance of a number of the Raman lines indicates the presence of di-methyl cyclohexane as well as normal octane. It is confirmed that out of its 6 isomers ortho-trans and meta-trans forms are present.

J. C. I.

**The absorption of electro-magnetic waves and the cellulose chemistry. IV.** S. Ueda. *J. Electrochem. Assoc. Japan*, 8, 155–161 (1940). — The dielectric behaviours of chem. combined water obtained by applying J. Tankard's method to the cellulose-water- $\text{Na}_2\text{S}_2\text{O}_3$  system, have been examd. by the absorption of electro-magnetic waves. The results obtained were the same for each. Accordingly, the chem. adsorbed water of bleached or mercerized cellulose was detd. by the absorption of electro-magnetic waves and the affinity of OH radical in glucose residue towards water was investigated for obtaining the insight into the structure of cellulose.

Author.

**Studies on the electric boundary disturbances. XVII. The form of water contained in organism viewed from the absorption of electro-magnetic waves. IV.** S. Ueda. *Bull. Agr. Chem. Soc. Japan*, 16, 175–183 (1940). — With the purpose of examg. the relationship of cold-resistibility of Japanese wheat and other corns to the form of water contained, the absorption of electro-magnetic waves of frequencies lower than 6,000  $\infty$  has been detd. over a temp. range

from  $-45^\circ\text{C}$  to  $10^\circ\text{C}$  with wheat, barley and rye—liquid paraffin systems, the water contents being about 18%. A deduction to the effect that the colder the country where the corn is raised the stronger the affinity of the corn towards water, was obtained from the comparison of dielectric properties thus detd. Author.

**Phosphorescence and afterglow of luminescent materials and other light-sources.** T. Harada and T. Kimura. *Trans. Illum. Eng. Soc. Japan*, 24, 69–76 (1940).

—The time of afterglow or phosphorescence of low and high press. mercury lamp and of various phosphorescent materials for fluorescent vapour lamp and television use was measured by cathode ray oscillograph. The time of afterglow of low press. mercury lamp tested was  $1.5 \times 10^{-8}$  sec. and that of high press. mercury lamp was longer by two powers of ten and increased with the vapour press. of mercury. The Ca-tungstate, Mg-tungstate, Zn-silicate, Zn-Be-silicate, Cd-silicate and Cd-borate were excited by 2537 Å line of mercury and found to follow monomolecular decay law. The Zn-sulphide and Zn-Cd-sulphide were excited by 3650 Å lines of mercury and found to follow the bimolecular decay law.

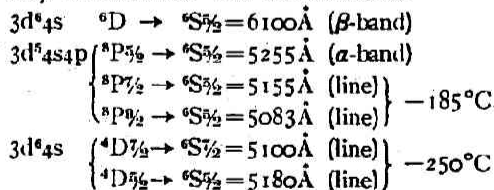
Authors.

**Studies on luminescent materials. V. On the fluorescence spectra of ZnS-CdS/Ag and ZnS-CdS/Cu crystalphosphors at 25°C and 185°C.** Y. Uehara. *J. Chem. Soc. Japan*, 61, 405–415 (1940). — The fluorescence spectra of ZnS-CdS phosphors, covering a compn. range between 0 and about 40 mol % CdS, activated by Ag and Cu were measured at  $-185^\circ\text{C}$  and  $25^\circ\text{C}$ . The obsd. distribution curves of fluorescence spectra were resolved in the several partial fluorescence bands. It was found that the max. of the energy of the partial fluorescence bands makes a shift from blue to red linearly with increasing CdS content.

**VI. On the relation between crystal structure and fluorescence spectra of ZnS-CdS crystalphosphors.** *ibid.*, 61, 553–

558 (1940).—In the present paper the author investigated the relation between crystal structure and fluorescence spectra of ZnS-CdS solid solns. covering a compn. range between 0 and about 40 mol % CdS. The lattice const. of ZnS-CdS system was measured by the X-ray powder method. It was found that lattice const. of ZnS-CdS system increases linearly with increasing CdS mol %. In the previous paper, the author could confirm that the position of the partial fluorescence bands of ZnS-CdS phosphors makes a shift linearly from blue to red with increasing CdS mol %. As the results, it can be interpreted that the energy gap between the excited and normal states decreases with decreasing lattice const., namely, decreasing electrostatic potential of the lattice.

**VII. Fluorescence spectra and theory of zincsilicate crystal phosphors.** *ibid.*, 61, 741—751 (1940).—Energy distribution curves of the fluorescence spectra of zincsilicate phosphors activated by manganese were measured at  $-185^{\circ}$  and  $25^{\circ}\text{C}$ . The fluorescence spectra of zincsilicate phosphors which have various components give one emission band at about  $5220 \text{ \AA}$  and  $6100 \text{ \AA}$  with lines superposed at  $5155 \text{ \AA}$  and  $5083 \text{ \AA}$ . The energy level diagram of the zincsilicate phosphors activated by manganese, based on the quantum mech. theory of solids, is given. It is pointed out that these fluorescence spectra may be correlated with the transitions



of the electron of the manganese atom in the activation centre. The theoretical interpretations, based on the zone-theory, are given for the mech. of the absorption spectra, excitation bands and photo-conductivity as well as the fluorescence spectra. Author.

**VIII. On the fluorescence spectra of ZnO-SiO<sub>2</sub> crystal phosphors.** Y. Uehara and Umekawa, U. *ibid.*, 61, 907—918

(1940).—The energy distribution curves of the fluorescence spectra of zincsilicate phosphors activated by W, Mo, Pb, U, Sb, Ta, Al, Sn, Bi, and Ti as well as pure zincsilicate phosphors containing no activator were measured at  $-185^{\circ}\text{C}$  and  $25^{\circ}\text{C}$ . It was found that the zincsilicate phosphors activated by the various activators quoted above, except Ti activator, give the same energy distribution curves of fluorescence spectra as that of zincsilicate phosphors activated by manganese. The zincsilicate phosphors activated by Ti shows a blue fluorescence and its fluorescence spectra has the same appearance as that of pure zincsilicate phosphors. Authors.

**IX. Fluorescence spectra and theory of cadmiumsilicate crystal phosphors.** Y. Uehara. *ibid.*, 61, 919—928 (1940).—In the present paper the author studied the properties of cadmiumsilicate phosphors activated by manganese. The energy distribution curves of fluorescence spectra of cadmiumsilicate phosphors which had various compns. were measured at  $-185^{\circ}\text{C}$  and  $25^{\circ}\text{C}$ . It is pointed out that the fluorescence spectra consist of six fluorescence bands at about  $5600 \text{ \AA}$  ( $\beta_6$ ),  $5870 \text{ \AA}$  ( $\beta_1$ ),  $6100 \text{ \AA}$  ( $\alpha$ ),  $6350 \text{ \AA}$  ( $\beta_2$ ),  $6600 \text{ \AA}$  ( $\beta_3$ ) and  $6800 \text{ \AA}$  ( $\beta_4$ ). Theoretical interpretations based on the zone-theory are given for the mech. of fluorescence-, absorption-, and excitation spectra and photoconductivity.

Author.

**Molecular structures of fluorobenzene and o-difluorobenzene studied by electron diffraction.** H. Osaka. *Bull. Chem. Soc. Japan*, 15, 31—36 (1940).—The molecular structures of fluorobenzene and o-difluorobenzene were investigated by the electron diffraction of the vapour. The apparatus used was of the de Laszlo type. The electron wave-length was about  $0.065 \text{ \AA}$  and the camera distance  $29.5 \text{ cm}$ . The diffraction photographs were interpreted by the visual method. The C-F distances in these molecules were detd. as  $1.34 \pm 0.04 \text{ \AA}$  and  $1.35 \pm 0.03 \text{ \AA}$ , resp. These distances are shorter than expected from the covalent radii of Pauling and Huggins. This

shortening is discussed in terms of resonance among several valence-bond structures. The dipole moment of halogen-substituted benzenes is considered in relation to the carbon-halogen distances and the double bond character of the linkage. Author.

**A study of oxide films on light metals by electron diffraction: Mg, Al and Be.** S. Yamaguchi. *Sci. Papers. Inst. Phys. Chem. Research*, 36, 463—470 (1939). —Electron diffraction patterns of Mg specimens, prep'd. by polishing the surface with coarse sandpaper, were taken after exposing them to air at room temp., at 200°, 300° and 400°C. The most intense ring of MgO is found, though faintly, in the pattern of the specimen left in air at room temp.; likewise, the most intense ring from Mg is seen faintly in the pattern of the specimen heated at 400°C. It is, therefore, concluded that Mg is masked with a thin film of MgO even at room temp., and the film is quite thin (10 Å or so) even after heating at 400°C. Although it is very difficult to obtain the diffraction patterns of Al oxides by the reflection method, the author succeeded in producing them by marking deep ditches on the metal. Precisely as in the case of Mg, it was possible to verify that Al is coated with a film of  $\gamma$ -Al<sub>2</sub>O<sub>3</sub>, while the specimen heated at 500°C is covered with a film of  $\alpha$ -Al<sub>2</sub>O<sub>3</sub>. With Be left at room temp., the pattern obtained from the surface precludes the possibility of even a trace of rings belonging to the BeO. Author.

On the optical anisotropy of mole-

cular crystals. I. Nitta. *Sci. Papers Inst. Phys. Chem. Research*, 37, 114—130 (1940). —For a case of the body-centred tetragonal lattice, it is shown that the double refraction D of a molecular crystal can be resolved into two terms D<sub>m</sub> and D<sub>s</sub>, the former depending on the optical anisotropy of the molecule (molecular double refraction) and the latter on the parameters of the crystal structure (structural double refraction). As illustrations, the principal polarizabilities for the molecules of pentaerythritol, pentaerythritol tetranitrate and pentaerythritol tetraacetate were calcd. from the optical and the X-ray data of these crystals. The values obtained stand in conformity with their molecular structure. For pentaerythritol crystal the temp. coeff. of the double refraction was also calcd. This agrees well with the obsd. value. Finally, the validity of the Lorentz-Lorenz relation applied to birefringent crystals and the implication of the molecular refraction for a liquid are briefly discussed. Author.

**A study of one component system of SiO<sub>2</sub> by means of X-rays.** K. Akiyama. *Waseda Ōyōkagaku Kaihō*, 17, 21—25 (1940). —Tridymite was analyzed by X-rays and its special distance det'd. The numerical values hitherto obtained are tabulated with those of cristobalite and quartz. The results obtained by X-ray analysis of silica gel which was calcinated for 2 hrs. at 900—1,500° was compared and it was found that crystallization occurs in the temp. range, 1,100—1,500°, and that the crystallized substance is cristobalite. J. C. L.

### 3—ELECTROCHEMISTRY AND THERMOCHEMISTRY

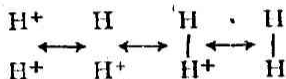
**The electrical characteristics of the air dry cell.** S. Makino and S. Takeshita. *Bull. Electrotech. Lab.*, 4, 614—618 (1940). —For the general purpose and the telephone use, the air dry cell of the round type was compared with the manganese dry cell of the

same type furnished by a representative manufacturer of Japan. The results obtained are briefly summarized as follows: 1. The shelf life of the air dry cell is superior to that of the manganese dry cell. 2. There are air dry cells of certain make which are extremely in-

ferior to manganese dry cells by the lowest intermittent test for the telephone use.

Authors.

**The mechanism of hydrogen electrode on the surface of Pt.** J. Horiuti and S. Ikusima. *Proc. Imp. Acad.*, 15, 36—44 (1939).—From the measurement of the rate of deuterium exchange reaction between water, hydrochloric acid, and NaOH soln. and the gaseous hydrogen in contact with them it is found that the mech. of the generation of hydrogen ( $2\text{H}^+ \rightarrow \text{H}_2$ ) in the hydrogen electrode is expressed by



and that the last step, i. e. the discharge of the hydrogen molecular ion ( $\text{H}_2^+$ ), is the rate detg. step.

J. C. I.

**The dielectric behaviours of anodic aluminium during its formation.** A. Miyata. *Sci. Papers Inst. Phys. Chem. Research*, 37, 147—176 (1940).—The dielectric measurement of anodic aluminium during its formation with const. current densities was carried out. With these results, the effect of the existense of the pre-oxidized film upon the formation can be made clear. According to the fact that the thickness of the active layer is uniquely given by the voltage across it, the conductivity of the active layer during formation should be proportional to the current density at operation. Examg. the series equivalent capacitance and the loss angle of the active layer, the striking effect of the current upon them was found to be amazing. Aside from the question, which of the two capacitances (equivalent series or parallel) should be taken, the dielectric performances of both bare and filmed aluminium were compared, using various current densities in acidic and alkaline solns. Next, the effect of an A.C. measuring potential difference (50c/s) upon the dielectric performances during the formation was investigated in a neutral soln. with the result of finding the distinct differences in the behavi-

ours of bare and filmed aluminium. Finally, the discontinuity of the forming current was ascertained by means of an oscillograph. The formation of anodic aluminium is brought about by many superposed spasmodic discharges. This phenomenon is more conspicuous in an alkaline soln. than in an acidic soln. With filmed aluminium these spontaneous discharges are very frequent and violent because of the instability of the unprotected active layer, and particularly so in an alkaline soln., when this phenomenon begins to occur when the voltage is as low as 40 V.

Author.

**The frequency characteristics of anodic aluminium during its formation:**

A. Miyata. *Sci. Papers Inst. Phys. Chem. Research*, 37, 177—204 (1940).—The frequency characteristics of anodic aluminium during formation was studied. First, when both bare and filmed aluminium in a neutral soln. at a const. current density of 25 mA/dm<sup>2</sup> were being formed, the dielectric measurements were carried out at several frequencies ranging from 50 c/s to 10,000 c/s. The results obtained suggest that their behaviours can be expressed by a simple equivalent network. The numerical value of each element of the network was actually calcd. by these measured results. For one of the cases, the network values were compared with the measured ones, and confirmed to agree well with these facts. Next, the absorption phenomena were considered from a theoretical aspect, and it was shown on the basis of Hopkinson's superposition law that an absorption phenomenon can be generally represented electrically by a series circuit of a resistance and a capacitance irrespective of frequency or impressed voltage. Particularly in the case of the filmed aluminium which shows very simple behaviours, the dielectric properties of the active layer alone were segregated and it was found that the capacitance of the active layer is strictly inversely proportional to the forming voltage. Then, the so-called capacitance of anodic aluminium was analyzed, and its components

were detd. separately. A proper phys. meaning was given to the absorption capacitance. To the question of the anodic capacitance, whether the equivalent series or parallel one should be taken (cf. the previous abstract), the right answer was at last given. Finally, the capacitance of the anodic aluminium during formation was investigated more thoroughly in several different solns., with both bare and filmed aluminium. The difference arising from their resp. features again supported the complete reciprocal law between the capacitance of the active layer and the forming voltage.

Author.

**The hydrogen ion concentration in the formation solution of anodic aluminium.** A. Miyata. *Sci. Papers Inst. Phys. Chem. Research*, 37, 232—273 (1940).—The hydrogen ion concn. and the conductivity of various solns. prepd. by adding  $\text{NH}_4\text{OH}$  to boric acid soln. at room temp. were previously measured. The preliminary treatments of the sample to be tested were also carefully specified as to polishing, cleansing and annealing. Under given conditions, the anodic behaviours of both bare and filmed aluminium were obsd. in detail. The specimens were completed into capacitors, and expts. were conducted to det. whether there were any characteristic differences found by changing the solns. in which the anodic aluminium was formed or whether the existence of the preoxidized film was advantageous to produce electrolytic capacitors. Finally, the specimens, which had been forming for a long time in several different solns., were suddenly removed from their cells and immersed in another given soln., either acidic or alkaline, to see the characteristic features of the resp. initial forming solns., or the configurations of the waste layer upon the active layer. Distinct differences were found between the behaviours

of bare aluminium and filmed aluminium.

Author.

**Thermodynamic properties of the mixed solution.** S. Kaneko. *Bull. Electrotech. Lab.*, 4, 282—286 (1940).—Thermodynamic properties of the mixed solns. of electrolytes and non-electrolytes are treated from the standpoint of statistical mech. Three cases are considered, namely; the mixed soln. of non-electrolytes, the mixed soln. of electrolytes, and the mixed soln. of electrolytes and non-electrolytes.

Author.

**Dielectric constant of gases.** S. Kaneko. *Bull. Electrotech. Lab.*, 4, 398—400 (1940).—Debye's dipole theory does not contradict the thermodynamic principle even when the satn. effect occurs.

Author.

**Apparent molal heat capacity of strong electrolytes.** S. Kaneko. *Bull. Electrotech. Lab.*, 4, 400—402 (1940).—The apparent molal heat capacity of strong electrolytes in the concd. soln. is calcd. from Debye-Hückel's theory of strong electrolytes.

Author.

**Diffusion coefficient of strong electrolytes.** S. Kaneko. *Bull. Electrotech. Lab.*, 4, 464—465 (1940).—The formula of the diffusion coeff. of strong electrolytes is derived from Debye-Hückel's theory of strong electrolytes and the diffusion coeff. of KCl is calcd. and compared with the exptl. data.

Author.

**Thermodynamics of liquid dielectrics.** S. Kaneko. *Bull. Electrotech. Lab.*, 4, 611—614 (1940).—Thermodynamic relation is not satisfied with theories of liquid dielectrics of Debye and Onsager. Only Eyring's theory of liquid dielectrics has no contradiction.

Author.

## 4—COLLOID CHEMISTRY AND SURFACE CHEMISTRY

**Molecular arrangement in thin films of some fatty acids and oils.** K. Tanaka. *Mem. Coll. Sci. Kyoto Imp. Univ.*, A, 12, 377-380 (1939). — The arrangement of molecules in thin films of some fatty acids and oils spread on a polished copper plate was examd. by the electron diffraction method. In some cases heating of the film in vacuum at a suitable temp. changed the manner of arrangement of the long-chain molecules at the surface of the film from irregular to regular. The manner of arrangement of the molecules in thin films of oils was found to depend upon the history of preservation of the oils. Classification of the property of oils was made in this respect. From the obsn. of the change of diffraction pattern of the film with temp. the transition-temp. of the film (the melting temp. of a thin surface layer having a regular molecular arrangement) was measured. It was in the ranges of 120°—130°C for stearic and palmitic acids, 55°—65°C for oleic and linolic acids and 50°—60°C for some oils. Author.

**A study on monomolecular films of esters of cyclic compounds.** A. Tattiri. *J. Chem. Soc. Japan*, 60, 442-450 (1939). —F-A relation of monomolecular films of long-chain esters of nine cyclic compds. and of three fatty acids was measured.

Substance	Type of Film	Limiting Area
Cetyl benzoate	Condensed	27.0 Å <sup>2</sup>
Cetyl phenylacetate	"	34.1
Cetyl hydrocinnamate	"	37.1
Cetyl phenylbutyrate	"	40.0
Cetyl cinnamate	"	33.0
Phenyl palmitate	Collapsed	—
Pyromucic acid cetyl ester	Condensed	27.1
Furfuracrylic acid cetyl ester	"	33.0
$\alpha$ -Furfuryl palmitate	Collapsed	—
Ethyl palmitate	Liq. expanded and condensed	20.5
Cetyl propionate	"	20.5
Cetyl palmitate	collapsed	—

The results obtained by N. K. Adam (*Proc. Roy. Soc. A*, 112, 362 (1926)) and Alexander and Schulman (*Proc. Roy. Soc. A*, 161, 115 (1937)) on the configuration and orientation of molecules of aliphatic esters under the water surface, are also applicable in the case of aromatic esters. The author calcd. the limiting areas diagrammatically from the data of atomic distance, valency angle and region of action, and found good agreement with the areas obsd. It was concluded on the configuration under the surface that the cyclic heads approached to the surface as near as possible and that molecules were folded to occupy the smallest area. Author.

**On the measurement of a small quantity of the substance adsorbed at the solid-liquid interface.** H. Akamatu. *J. Chem. Soc. Japan*, 61, 470-474 (1940). —To measure the quantity of the solute adsorbed from the soln., the concns. of solns. before and after the adsorption were detd. by measuring their densities by the float method. In this report, the adsorbent is glass powder and the solns. are toluene solns. of organic acids. The quantity of the substance adsorbed, which is in the order of 10<sup>-6</sup> mol per lg. of adsorbent, was detd. Author.

**The synthesis of benzene and activated adsorption of H<sub>2</sub>, CO, CO<sub>2</sub>, and H<sub>2</sub>O on cobalt and iron.** S. Matsumura, K. Tarama and S. Kodama. *Sci. Papers Inst. Phys. Chem. Research*, 37, 302-322 (1940). —The activated adsorptions of H<sub>2</sub>, CO, CO<sub>2</sub> and H<sub>2</sub>O on the surface of cobalt and iron, the two main constituents of catalysts in the synthesis of benzene, were measured. From these results a mech. of benzene synthesis is proposed and discussed as follows: (1) At first, carbide is formed from carbon-monoxide on the surface of the catalyst, thus; CO + 3Me = Me<sub>3</sub>C + MeO. Carbide then reacts with

atomic hydrogens which are formed on the surface by adsorption, giving  $>CH_2$  group. The  $CH_2$  groups suffer polymerisation and reduction while remaining on the surface of the catalyst and are converted to various kinds of hydrocarbons. Hydrocarbons thus formed then evaporate. It is considered that the processes of polymerisation, reduction and evaporation steadily go on sustaining the condition of some kind of equil. (2) The reason why hydrocarbons are formed above  $160^\circ C$  with cobalt catalyst is that the amt. of hydrogen activatedly adsorbed on the surface of catalyst reaches a considerable amt. at this temp. (3) The reason that the temp. at which the reaction takes place with iron catalyst is higher than that with the cobalt is that the temp. of the formation of carbide on the iron is higher than on the cobalt. (4)  $H_2O$  is produced with the cobalt, while  $CO_2$  is with the iron. A high desorption velocity of  $H_2O$  on the surface of cobalt explains this difference.

Authors.

**On the sorption of chlorine by active charcoal. III. The sorption isotherms at low pressure.** K. Arai. *Bull. Inst. Phys. Chem. Research*, 19, 148—159 (1940).—The sorption of chlorine by sugar charcoal activated by heating at  $900^\circ$  for 2 hours, is detd. by a static method. The instrument used for the measurement is an all-glass app. which contains Jackson's glass spring manometer and McBain's quartz spring balance. The sorption isotherms are detd. at  $20^\circ$ ,  $30^\circ$ , and  $40^\circ$  over a range of press. between 0.05—50 mm Hg. The results obtained are in good agreement with Freundlich's eq. The following eqs. are derived from the exptl. data by the method of least squares:  $\alpha_{20^\circ} = 127.94 p^{0.199}$ ,  $\alpha_{30^\circ} = 113.25 p^{0.123}$ ,  $\alpha_{40^\circ} = 93.54 p^{0.160}$ , where  $\alpha$  is the sorption amt. expressed in mg per 1 g charcoal, and  $p$  is the equil. press. in mm Hg. The empirical eqs. for the isobar (relation between the amt. sorbed and the temp. at the const. equil. press.) are calcd. as follows:  $\alpha_p = \alpha_0 - Kt$ , where  $\alpha_0$  is the amt. sorbed to  $0^\circ$  and  $K$  is the const. The values of  $K$  are

obtained as follows:

$p$ (mm)...	10	20	30	40
$K$ .....	1.3475	1.1400	1.0075	0.9000

$\alpha_0$  can also be represented by Freundlich's eq.,  $\alpha_0 = 165.58 p^{0.0678}$ . The following eq. between  $K$  and  $p$  is obtained,  $K = k - m \log p$ , where  $k = 2.0968$  and  $m = 0.742$ ; thus the general eq. for the system can be expressed as follows:  $\alpha = \alpha_0 - (k - m \log p)t$ . The following empirical eqs. hold for isostere (relation between the equil. press. and absolute temp. at the const. amt. sorbed),  $\log p_{150} = 10.2159 - \frac{2796.7}{T}$ ,  $\log p_{170} = 7.7264 - \frac{1910.0}{T}$ . The differential isosteric heats of sorption are also calcd.

Authors.

**The absorption of bichromates by wool.** S. Ohuzi. *Sansigaku Zasshi*, 11, 149—154 (1939).—The absorption of  $M_2Cr_2O_7$  ( $M: NH_4, K, Na$ ) was measured by using 1g of wool. The absorption agrees with the adsorption isotherm of Freundlich. The relation of the absorption of salts is thus:  $(NH_4)_2Cr_2O_7 > K_2Cr_2O_7 > Na_2Cr_2O_7$ . The absorption velocity and the relation between the absorbed amt. and temp. are expressed resp. by  $S/(S-x) = Kt^n$  and  $x = Kt^2$ , where  $S$  is the satd. absorbed amt.,  $x$  the absorbed amt. at a time  $t$ ,  $K$  and  $n$  consts. The absorbed amt. is larger in the case of acid.

J. C. L.

**Studies on the catalytic oxidation-reduction by some metallic complex salts. XV. Catalytic oxidation by copper complex salts.** T. Iwasaki. *J. Chem. Soc. Japan*, 61, 400—404 (1940).—The catalytic oxidation of polyphenols and some other inorganic salts caused by the addition of copper complex salts was studied by measuring the absorption of oxygen. The polyphenols, e. g., pyrogallol, are easily oxidised. The inorganic substances, e. g., ammonium chloride, sodium nitrite, etc., are less easily influenced by the addition of copper complex salts. The salts such as:  $K_2 \left[ Cu \left( \begin{array}{c} CH_2-CO \\ | \quad \quad | \\ CH_2-CO \end{array} \right)_4 N \right] \cdot 6H_2O$ ,  $[Cu(en)_2](SCN)_2 \cdot H_2O$ ,  $[Cu(en)_3](CH_3CO_2)_2$

$2\text{H}_2\text{O}$ , etc., are considered to be most effective for the oxidation. Author.

**On the catalytic decomposition of oxalic acid by colloidal platinum. I.** Sano. *Bull. Chem. Soc. Japan*, 15, 196—204 (1940).—(1) The decompn. of aqu. solns. of oxalic acid (0.10, 0.05 and 0.025 N) due to oxidation accelerated by colloidal platinum obtained through the process of dialysis of colloidal platinum-carbonyl was investigated, in the presence of oxygen and diffused daylight, during a period extending over 30 hours at  $50.0^\circ\text{C}$ . (2) It appears that the greater part of the reaction proceeds in accordance with the formula for the type of zero order after it passed incipiently through a short period of transition and the rate of reaction is scarcely influenced by the concn. of reacting soln. (3) It was definitely shown that the reaction is retarded if the supply of oxygen is cut off. (4) The above results are explained in conformity with the mech. of reaction previously proposed. Author.

**Studies on the catalytic oxidation-reduction of some metallic complex salts. XII. Catalytic oxidation of pyrogallol by the complex salts of platinum group.** S. Kawakubo. *J. Chem. Soc. Japan*, 60, 1031—1036 (1939).—14 kinds of ammin-complex, chiefly of platinum group, were synthesized and the catalytic oxidation of pyrogallol by these salts studied. Results: (1) What give slight catalytic action:  $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ ,  $[\text{Pd}(\text{NH}_3)_2(\text{NO}_2)_2]$  and  $[\text{Ru}(\text{NH}_3)_4(\text{OH})\text{Cl}]\text{Cl}\cdot\text{H}_2\text{O}$ . (2) What give no catalytic action:  $[\text{Pt en}_2]\text{Cl}_2$ ,  $[\text{Pt}(\text{NH}_3)_4(\text{OH})_2]\text{Cl}_2$ ,  $[\text{Pd en}_2]\text{Cl}_2$ ,  $[\text{Ru}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}\cdot 2\text{H}_2\text{O}$ ,  $[\text{Rh}(\text{Py})_3\text{Cl}_2]\text{Cl}$  and  $[\text{Rh}(\text{NH}_3)_5\text{H}_2\text{O}]\text{Cl}_3$ . (3) What give neg. catalytic action:  $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}_2$ ,  $[\text{Pt}(\text{NH}_3)_4\text{Br}_2]\text{Cl}_2$ ,  $[\text{Pt en}]\text{Cl}_2$ ,  $[\text{Pd}(\text{NH}_3)_2\text{Cl}_2]$  and  $[\text{Ru en}_2(\text{OH})\text{Cl}]\text{Cl}$ .

J. C. I.

**The effect of gases upon the catalytic decomposition of oxalic acid by colloidal platinum. I.** Sano. *Bull. Chem.*

*Soc. Japan*, 15, 204—206 (1940).—(1) The influences of gases, such as oxygen, nitrogen as well as air under reduced press., upon the decompn. of aqu. soln. of oxalic acid (0.05 N) were examd. at  $50.0^\circ\text{C}$ , in the presence of colloidal platinum, obtained from colloidal platinum-carbonyl by dialysis and under diffused daylight. (2) Oxygen alone has a marked effect in accelerating the decompn., whereas the two others have none. (3) This gives support to the mech. of reaction previously discussed. Author.

**Studies on the catalytic activity of mineral springs in Japan. I. On the catalytic properties of artificial mineral waters.** Y. Kinugasa and Y. Hattori. *Eisei Kagaku*, 12, 1—38 (1940).—The authors have examd. the catalytic power of artificial mineral waters containing manganous or ferrous salts by measuring the quantities of  $\text{H}_2\text{O}_2$  decomposed by the waters, according to the technique described by L. Fresenius (*Z. anorg. u. allgem. chem.* 160, 273, (1927)). Authors.

**Studies on the freezing of inorganic hydrogels. (The preliminary report).** S. Uno. *J. Soc. Chem. Ind. Japan*, 43, 475—478 (1940).—The studies have been made on the effects of freezing upon several kinds of typical inorganic hydrogels including  $\text{Al}(\text{OH})_3$ ,  $\text{Fe}(\text{OH})_3$ ,  $\text{Ni}(\text{OH})_2$ ,  $\text{Zn}(\text{OH})_2$ ,  $\text{Cu}(\text{OH})_2$ ,  $\text{Co}(\text{OH})_2$ ,  $\text{Si}(\text{OH})_4$ ,  $\text{ZnCO}_3$ ,  $\text{CoCO}_3$ ,  $\text{NiCO}_3$ ,  $\text{CuCO}_3$ ,  $\text{PbS}$ ,  $\text{CdS}$ ,  $\text{CuS}$ ,  $\text{ZnS}$ ,  $\text{CoS}$  and  $\text{MnS}$ . These compds. were pptd. from the dilute soln. by the ordinary method and frozen in contact with the mother liquor or after washing by repeated decantation. These voluminous and gelatinous ppts. were converted when frozen, into compact form, which readily settled down and was filtered off easily. The products examd. under microscope appeared to consist of granules, fragments or plates, which showed well-defined irregular edges. Some of the products reacted with the polarized light. This optical activity may possibly be ascribed to the crystalline structure of these gelatinous ppts. or to the strain set up by the



press. due to the formation of ice. Author.

**The influence of temperature on the formation of platinum-carbonyl sol.**

I. Sano. *Bull. Chem. Soc. Japan*, 15, 106-113 (1940). — (1) The influence of the temp. of prepn. on the formation of platinum-carbonyl sol from the chloroplatinic acid soln. by the action of carbon monoxide was investigated at various temps. between 5° and 80° C; together with the influence of the concn. of soln. ranging from 0.01 to 0.1% with respect to  $H_2PtCl_6 \cdot 6H_2O$ . (2) Stable sols having a tinge of red with a dash of purple may be produced from the solns. of concns. between 0.01 and 0.08% in a wide range of temp.; sols of various colours such as brownish red, brown as well as dark brown may be formed in the same limits of concn. as the above at the elevated temps. (3) Sols tinged with red slightly inclining to purple may be obtained, though unstable, from the 0.1% acid solns. only at lower temps. (2) The above-mentioned colouration effects were spectroscopically analyzed with the Nutting's spectrophotometer, and it was found that the extinction curves for the sols tinged with red

reach a max. at about 540 m $\mu$ , while those for the sols with a tinge varying from brown to black decrease monotonously with the increasing wave-length. Author.

**The kinetics of the hydrogenation of propylene on a nickel catalyst.** O. Toyama. *This Journal*, 14, 86-100 (1940).

**Note on the disintegration of the starch paste caused by the irradiation of ultrasonic waves.** S. Ono. *This Journal*, 14, 101 (1940).

**Formation of the silver hydrosol by means of light.** S. Yagi. *This Journal*, 14, 115-127 (1940).

**A note on the adsorption of hydrogen on reduced nickel.** S. Iijima. *This Journal*, 14, 128-136 (1940).

**Studies on Organogels. I. The gel from cadmium oleate oleic acid solution.** I. Yamakita. *This Journal*, 14, 146-153 (1940).