

General and Physical Chemistry.

Refractive Power of Liquid Hydrogen. WALTHER MEISSNER (*Ber. Deut. physikal. Ges.*, 1913, **15**, 540—554).—Liquid hydrogen was produced by means of a Nernst liquefaction apparatus, which is described in the paper. The refractive index was determined by Wiedemann's method. The following refraction quotients, between liquid hydrogen and the gas between the suspended parallel plates, are found: white light, 1.1087, $\lambda = 0.656\mu$, 1.1098, $\lambda = 0.589\mu$, 1.1096 and $\lambda = 0.491\mu$, 1.1101. The relationship between the refractions of liquid and gaseous hydrogen is considered, and the values of liquid hydrogen are calculated. The calculated values agree with the observed values within the limits of experimental error. Liquid hydrogen is shown to possess no dispersion of magnitude greater than the experimental error. J. F. S.

Double Spectrum of Sodium Chloride. WILDER D. BANCROFT (*Eighth Inter. Cong. App. Chem.*, 1912, **20**, 37—43).—The author considers the causes of the differently coloured luminescence of sodium salts under different conditions. It is shown that when sodium burns slowly in chlorine or oxygen a blue light is emitted; the same light is emitted when sodium chloride is fused, when sodium chloride is placed in the layer separating the oxidising and reducing zones of a Bunsen flame, when sodium chloride is precipitated by alcohol or hydrochloric acid, and when sodium chloride crystals are crushed. The light in all these cases is produced by the change from sodium ion to undissociated sodium chloride. Cathode rays excite the blue luminescence in sodium chloride, whilst canal rays excite a yellow luminescence. The blue luminescence in the Bunsen flame is found where the rate of oxidation of the reduced sodium is slowest, at the surface between the oxidising and reducing zones. The yellow luminescence is observed where the rate of oxidation is higher, that is, in the oxidising zone. The simplest assumption in regard to the reaction producing the yellow sodium flame is that it is due to the change from sodium to sodium ion. This assumption is inadequate because it does not take into account the other spectra of sodium observed by Lenard (*Ann. Physik*, 1903, [iv], **11**, 636) and Wood (*Astrophys. Journ.*, 1911, 72). Under the influence of cathode rays potassium iodide emits green light. Part of this light is probably due to the iodine, and it seems possible that the chlorine may be responsible for some of the white light observed with many chlorides. Whilst it is probable that the crystalloluminescence and the triboluminescence of potassium iodide are the same as the cathodoluminescence of this salt, the experimental evidence is insufficient definitely to decide the question. J. F. S.

Vapours and Band Absorption [Spectra]. F. BURGER and JOHANNES KOENIGSBERGER (*Physikal. Zeitsch.*, 1913, **14**, 725—726. Compare this vol., ii, 85).—An answer to Stark (this vol., ii, 539)
J. F. S.

Absorption Spectra in the Red and Near Infra-red. AUGUST H. PFUND (*Eighth Inter. Cong. App. Chem.*, 1912, **20**, 279—287).—The author has examined the absorption in the region 0.55μ — 1.5μ of ruby glass, cobalt glass, and chromium glass, also aqueous solutions of soluble Prussian-blue, sodium chromate mixed with cyanin, naphthol-green, naphthol-green mixed with cyanin, neodymium nitrate and distilled water. Absorption curves are given for all the substances.
J. F. S.

Visible and Ultra-violet [Absorption] Spectra of Orange and Yellow Dyes Authorised for Use in Confectionery. GUSTAVE MASSOL and A. FAUCON (*Bull. Soc. chim.*, 1913, [iv], **13**, 700—704. Compare this vol., ii, 264, 542).—Solutions of orange I, chrysoine, naphthol-yellow S, and auramine O in solutions of the concentration 1:10,000 were examined by the method previously described. Orange I allows all visible light up to the D-line to pass through; chrysoine allows a small amount of the green to pass; naphthol-yellow S rather more of the green; and auramine O transmits the whole of the green. In the invisible spectrum, chrysoine has no absorption bands. Orange I and naphthol-yellow S have each one band in the ultra-violet; the latter about $\lambda=285$, the former about 260. Auramine O has three bands in the ultra-violet at $\lambda=350$, 310, and 265.
J. F. S.

Absorption of Ultra-violet Rays by Some Organic Colouring Matters in Aqueous Solution. GUSTAVE MASSOL and A. FAUCON (*Compt. rend.*, 1913, **157**, 206—209).—The authors have studied the absorption of ultra-violet rays by aqueous solutions of the twenty-one colouring matters authorised for use in confectionery. These colours divide into two groups:

1. Those which absorb only the radiations of short wave-length.
2. Those which absorb both radiations of short and long wave-length, whilst allowing the intermediate ones to pass.

The rays used were between λ 2200 and 4045.

Group 1 comprises three pinks, eight reds, one blue, and two violets; whilst group 2 contains one orange, three yellows, two greens, and one blue.

Some of the colours possess distinctive absorption bands, which are of use in characterising them. These are set out in detail.

W. G.

Valency Electrons, Colour and Fluorescence. HANS VON LIEBIG (*Zeitsch. Elektrochem.*, 1913, **19**, 559—570).—Polemical against Stark (this vol., ii, 456). A long criticism of Stark's views with regard to the constitution of organic substances and their fluorescence.
J. F. S.

Connexion between Fluorescence and Ionisation. JOHANNES STARK (*Ann. Physik*, 1913, [iv], **41**, 728—738).—Polemical against Volmer (this vol., ii, 456) and Pauli (this vol., ii, 456). The author also considers theoretically the relationship between fluorescence and ionisation of benzene, naphthalene and anthracene vapours.

J. F. S.

Oxidation and Luminescence. BLANCHETIERE (*Compt. rend.*, 1913, **157**, 118—121. Compare Ville and Derrien, this vol., ii, 654).—On oxidation by a mixture of hydrogen peroxide and sodium hypochlorite, certain glyoxaline derivatives, 2:4:5-triphenylglyoxaline (lophine), amarine, and hydrobenzamide, show marked luminescence. The examination, under similar conditions, of a large number of organic compounds, having no chemical relation with glyoxaline, has never given luminescence. Certain natural products, such as urine, infusion of tea, and extract of meat, and many other substances, exhibit marked luminescence, but the author is as yet unable definitely to fix on any organic complex the oxidation of which results in luminescence.

W. G.

A New Luminescence of Calcium Compounds in the Hydrogen Flame, particularly those containing Bismuth or Manganese, and a Method of Detecting Traces of These Metals. JULIUS DONAU (*Monatsh.*, 1913, **34**, 949—955).—The author shows that when calcium compounds are drawn through a non-luminous hydrogen flame, a bluish-green luminescence is produced. This is not produced by all calcium compounds, but only by those which contain traces of manganese. When a trace of a bismuth salt was placed on a piece of chalk and drawn through a hydrogen flame, a brilliant blue luminescence was produced. It is shown that, by taking pure chalk or gypsum and placing a drop of a solution containing a bismuth or manganese compound and then heating this on the lower edge of a hydrogen flame, traces of these metals may be readily detected. The reaction can be obtained for one ten-millionth of a milligram of bismuth and a millionth of a milligram of manganese. The luminescence is not affected by the presence of other metals. Barium and strontium compounds show similar but much less marked reactions.

J. F. S.

Experiments on Crystalloluminescence. EARL F. FARNAU (*Eighth Inter. Cong. App. Chem.*, 1912, **20**, 127—128).—The author has noted the colour of the light emitted when sodium chloride, sodium bromide, sodium iodide, potassium chloride, potassium bromide, and potassium iodide were respectively precipitated from solution by alcohol, subjected to cathode rays, and formed from their elements. It is shown that the colour of the light emitted in the chemical reaction is the same as that produced during precipitation and during exposure to cathode rays.

J. F. S.

The Walden Reaction. CECIL L. HORTON (*Chem. News*, 1913, **108**, 37).—Of the various reagents which have been employed to

effect substitutions and replacements in the study of the Walden inversion, only phosphorus pentachloride exhibits a constant behaviour, its action always being accompanied by a change in the sign of the rotation. With all other reagents the direction of the action is apparently dependent on the number of free carboxyl groups present in the parent substance. When the number of free carboxyl groups is even, the influence on the sign of the rotation is the reverse of that if the number of free carboxyls is odd. Thus the action of thionyl chloride, sodium hydroxide, potassium hydroxide, sodium methoxide, and ammonia on an active mono-carboxylic acid gives rise to an active product having the same sign as that of the parent substance, whereas, if the latter contains no free carboxyl group or an odd number of carboxyl groups, the product has the opposite sign. The action of silver oxide, water, nitrous acid, nitrosyl chloride, and nitrosyl bromide is the reverse of that of the reagents last mentioned. Of the twenty-six examples quoted, only one forms an exception to the above rule, namely, *d*- α -bromoisovaleric acid, which, under the influence of ammonia, gives rise to *l*-valine, whereas the *d*-isomeride would be expected.

F. B.

Action of Light on Water Vapour and Electrolytic Gas.

IVAN J. ANDRÉEV (*Zeitsch. Elektrochem.*, 1913, 19, 551—552).—Polemical against Coehn and Grote (*A.*, 1912, ii, 1118). The author answers the criticism against his work (*A.*, 1912, ii, 112).

J. F. S.

Action of Ultra-violet Rays on Solutions of Hydrogen Peroxide. VICTOR HENRI and RENÉ WURMSER (*Compt. rend.*, 1913, 157, 126—128).—A study of the photochemical decomposition of hydrogen peroxide by monochromatic light from the ultra-violet portion of the spectrum. The results confirm those of Tian for total light (compare *A.*, 1911, ii, 35) that the reaction is uni-molecular, and that the velocity of decomposition is proportional to the concentration. For each wave-length the velocity is proportional to the incident energy. It is further proportional to the absorbed energy, the factor being a constant for wave-lengths between λ 2800 and 2060, the photochemical susceptibility varying proportionately with the absorption. Einstein's law of photochemical equivalence does not apply to the decomposition of hydrogen peroxide. The energy which must be absorbed for the decomposition of one gram-molecule of hydrogen peroxide is practically equal to the energy given out by the decomposition of the same amount of hydrogen peroxide in the dark. W. G.

Additive Reactions between Carbon Monoxide and Other Gases under the Influence of Ultra-violet Rays.

DANIEL BERTHELOT and HENRY GAUDECHON (*Compt. rend.*, 1913, 157, 129—131).—The aptitude of carbon monoxide to form additive products is shown by its behaviour towards certain gases under the influence of ultra-violet light. In the presence of nitric oxide, a

small proportion of the carbon monoxide is oxidised by the oxygen set free from the decomposition of the nitric oxide. With water the reaction is more complex, one part of the carbon monoxide combining directly with the water, yielding formic acid, whilst the rest combines with the hydrogen and oxygen, resulting from the dissociation of the water, to give formaldehyde and carbon dioxide respectively (compare A., 1910, ii, 564, 606). Of the halogens, chlorine combines with carbon monoxide, but bromine and iodine are without action even in the ultra-violet light. Whilst combining with ammonia, it is without action on hydrogen phosphide or arsenide, and it does not react with hydrogen sulphide or free sulphur.

W. G.

Influence of the Wave-length on the Velocity of a Photochemical Reaction. MARCEL BOLL (*Compt. rend.*, 1913, 157, 115—118. Compare this vol., ii, 265).—From a study of the photochemical hydrolysis of the hydrochloroplatinic acids, the author has deduced the following formula governing the reaction: $m = \psi e^{av} P_0 s t c (1 - e^{-xlc}) / x$, where m is the weight of substance destroyed in a given time t ; ψ is a constant for each substance considered being its "photochemical lability"; v is the frequency, and P_0 the power of the incident radiation; s is the surface area irradiated; c the concentration of the solution; l the thickness of the layer; and x the coefficient of absorption. The constant ψ depends on the temperature and the nature of the reaction.

W. G.

Wave-length and Velocity of Reaction. LUDWIK BRUNER (*Zeitsch. Elektrochem.*, 1913, 19, 555—558).—The author considers and criticises the work of Winther (this vol., ii, 458) and Plotnikov (A., 1911, ii, 4, 452), and draws the conclusion that up to the present there is no evidence that photochemical reactions are influenced by the wave-length of the acting light, but rather that every kind of absorbed light energy plays an equal part in the velocity of the change.

J. F. S.

A Simple Method of Counting α - and β -Rays. HANS GEIGER (*Ber. Deut. physikal. Ges.*, 1913, 15, 534—539).—An apparatus consisting of a brass cylindrical box of 2 cm. diameter, fitted with an ebonite cover through which a metal rod passes, is described for the purpose of counting the α - and β -particles emitted by a radioactive substance. The bottom of the box is perforated by a round hole, and the rod is sharpened to a fine point. The box is raised to a potential of 1200 volts, and the rod is connected to an electrometer. The radioactive substance is placed at a short distance from the hole, the entrance of α - or β -particles into the chamber causes a passage of electricity to the electrometer, and from the amount of deflexion the number of particles can be calculated. By covering the opening by a piece of lead, the apparatus may also be used for counting γ -rays, although in this case the deflexion of the electrometer is due to secondary β -rays

(compare also Rutherford and Geiger (A., 1908, ii, 794; 1912, ii, 1021). J. F. S.

A Method of Determining the Number of Ions Produced by an α -Particle of Polonium. RENÉ GIRARD (*Le Radium*, 1913, 10, 195—198).—The method consists (1) in determining in absolute measure the saturation current I given by a film of polonium, supposed to be infinitely thin; (2) in counting the number of α -particles given in a known time in a small solid angle, and calculating N the total number given per second, supposing the emission is uniform in all directions. If e is the charge on an ion, and X the required number of ions produced per α -particle, $X = I/Ne$. The film of polonium was deposited from hydrochloric acid on a silver plate, which retained its brilliance and polish. The saturation current was measured by means of the quartz electric balance, and the α -particles were enumerated by means of a zinc sulphide screen in a vacuum. The mean value found for X was 116,000, the accuracy being estimated at 10%. This number is very much inferior to that found by Geiger (162,000) and by Taylor (164,000). The difference is ascribed to the fact that the ionisation current was measured for all the α -rays emitted over a hemisphere rather than for a narrow parallel pencil, and that some of the more oblique α -rays suffer appreciable absorption in the film of polonium. F. S.

Effect of Temperature on Cathodoluminescence. EARL F. FARNAU (*Eighth Inter. Cong. App. Chem.*, 1912, 20, 133—135).—Starting from the assumption that all forms of luminescence are due to chemical reaction, the author draws the conclusion that those conditions which increase the velocity of chemical reaction will increase the intensity of the luminescence. Cadmium sulphate and potassium bromide were placed in cathode tubes and cooled with liquid air, and as the salts cooled the luminescences decreased in intensity and finally vanished, the luminescence reappearing when the cooling agent was removed, thus confirming the author's initial assumption. J. F. S.

Radiation of Radium at the Temperature of Liquid Hydrogen. (Mme.) P. CURIE and H. KAMERLINGH ONNES (*Proc. K. Akad. Wetensch. Amsterdam*, 1913, 15, 1430—1441, and *Le Radium*, 1913, 10, 181—186. Compare P. Curie, A., 1903, ii, 50, 255).—The ionisation produced by the γ -rays of radium at the temperature of liquid hydrogen, 20.3° Abs. has been compared with the ionisation at the ordinary temperature. The measurements were made in hydrogen. It is shown that no change of radiation occurs which has a greater value than 0.1%, and probably not even of 0.02%. Preliminary experiments were also made with polonium, and the same results indicated. J. F. S.

Radium Content of Some Alabama Coals. STEWART J. LLOYD and JOHN CUNNINGHAM (*Amer. Chem. J.*, 1913, 50, 47—51).—An examination of representative samples of various coals of Alabama

has shown that the amount of radium present ranges from 0.028×10^{-12} to 0.37×10^{-12} , with an average of 0.166×10^{-12} per gram of coal, or from 0.51×10^{-12} to 7.05×10^{-12} , with an average of 2.15×10^{-12} per gram of ash. The wide variation in the amount of radium per gram of ash is probably due to a specific tendency of certain plants to secrete exceptionally large quantities. E. G.

Colloidal Solutions of Radioactive Substances. FRITZ PANETH (*Kolloid Zeitsch.*, 1913, **13**, 1—4).—It is shown that the separation of radium-*E* and polonium from radioactive lead (Paneth, *Sitzungsber. K. Akad. Wiss. Wien*, 1912, **121**, 2193) by dialysis is due to the fact that radium-*E* and polonium are both easily hydrolysed in aqueous solution. The basic salts or hydroxides thus formed remain in solution as colloids, and consequently do not pass through the membrane with lead and radium-*D*. If, on the other hand, a nitric acid solution of radioactive lead is dialysed, there is no separation. J. F. S.

Electric Conductivity of Thin Liquid Layers. A. UNGERER (*Physikal. Zeitsch.*, 1913, **14**, 685—688).—The electro-conductivity of silver nitrate and sodium chloride solutions of varying concentrations has been compared with the conductivity of similar solutions in thin layers of the order 10^{-4} mm. The thin layers were obtained by pressing two plane glass plates together and regulating the thickness of the layer by means of the number and colour of the Newton rings visible. The conductivity was determined by means of a telephone arrangement, and also by direct current and a galvanometer. It is shown that conductivity ratio of the thin layer to the ordinary solution is independent of the concentration, that is, the conductivity of thin layers is relatively the same as that of solutions of ordinary dimensions. J. F. S.

Conductivity, Temperature-coefficients of Conductivity, Dissociation and Dissociation Constants of Certain Organic Acids between 0° and 65° . LESLIE D. SMITH and HARRY C. JONES (*Amer. Chem. J.*, 1913, **50**, 1—46).—In continuation of earlier work on the conductivity and dissociation of organic acids (White and Jones, A., 1910, ii, 13, 821; Wightman and Jones, A., 1911, ii, 689; 1912, ii, 1035), a study has been made of a large number of acids, and the molecular conductivities, temperature-coefficients, limiting conductivities, percentage dissociation, and dissociation constants at various temperatures between 0° and 65° are recorded.

The results confirm most of the relations established previously. With regard to isomeric acids, it has been found that the ortho- and *cis*-forms are the stronger, that is, have the larger dissociation constants. It is also shown that the migration velocities of the anions are functions of the number of atoms they contain, and that most dibasic acids dissociate like monobasic acids. E. G.

Electric Conductivity of Salt Vapours. II. GERHARD C. SCHMIDT (*Ann. Physik*, 1913, [iv], **41**, 673—708. Compare A., 1911, ii, 788).—A continuation of previous work on the conductivity of

salt vapours. It is shown that the conductivity of the halogen salts of zinc and cadmium is independent of the time, when a concentration change is not brought about by the current and when the surface of the solid is kept constant. The fall in the conductivity, which is often observed as the measurements proceed, is due to a migration of the salt to the central electrode, with consequent change of concentration, and also to the change in the surface of the solid. The increase which is observed at the commencement of the measurements is due to the fact that the vapour only slowly reaches the electrode. The hypothesis previously stated by the author (*loc. cit.*) does not coincide with facts. With a constant surface, the concentration being kept constant, the conductivity first increases with increasing pressure, and then falls. The conductivity increases with increasing temperature.

J. F. S.

Liquid Helium. II. The Electrical Resistance of Pure Metals, etc. VII. The Potential Difference Necessary for the Electric Current Through Mercury Below 4.19°K . H. KAMERLINGH ONNES (*Proc. K. Akad. Wetensch. Amsterdam*, 1913, 15, 1406—1430).—The resistance of mercury at helium temperatures has been determined. It is shown that when a definite current strength known as the "threshold value" has been reached, the resistance practically disappears when the temperature 4.19°K is reached. The ratio of the value at 2.45°K to that at 273°K is expressed by 2×10^{-10} ohm. This represents the lowest value. It is shown that as the current strength is increased, the resistance rises due to heating effects occurring in the mercury thread itself, and not in any way due to conduction from the leads. The residual resistance of the mercury is evidently due to the mercury itself, and not to impurities, for mercury artificially amalgamated with traces of gold and cadmium lost its resistance at 4.19°K . Even mercury used for mirror preparation lost its resistance in the same way.

J. F. S.

Conductivity and Ionisation of Sodium Ethoxide, Potassium Ethoxide, Lithium Ethoxide, Sodium Phenoxide, Potassium Phenoxide, Lithium Phenoxide, Sodium Phenylthiourazole, Sodium Iodide, Sodium Bromide, and of Mixtures of these Electrolytes in Absolute Ethyl Alcohol at 0° , 25° , and 35° . H. C. ROBERTSON and SOLOMON F. ACREE (*Eighth Inter. Cong. App. Chem.*, 1912, 26, 609).—The conductivities of these compounds in alcohol at 0° , 25° , and 35° have been determined in concentrations ranging from N to $N/256,000$. The percentage ionisation is much lower in concentrated alcoholic solutions than in the corresponding aqueous solutions, the ionisation of N -solutions of sodium ethoxide and sodium phenoxide, for example, being 14.8% and 12.2% respectively at 25° . The decrease in ionisation with rise of temperature is about 0.4—0.5% per degree. The maximum molecular conductivity is attained in concentrations between $N/2000$ and $N/8000$. The molecular conductivities of N , $N/2$, $N/4$, $N/8$, $N/16$, $N/32$, and

$N/8000$ solutions of sodium ethoxide at 25° are 4.93, 7.78, 10.37, 13.04, 15.98, 19.16, and 33.2 respectively. E. G.

Electromotive Behaviour of Some Cadmium Elements. L. WILLIAM ÖHOLM (*Chem. Zentr.*, 1913, i, 1853; from *Acta Soc. Sci. Fennicæ*, 1912, 41, No. 1).—The element $\text{Cd} \mid \text{CdCl}_2 \mid \text{Hg}_2\text{Cl}_2 \mid \text{Hg}$ has an *E.M.F.* of 0.6717—0.6718 volt at 18° in saturated solutions. The variation with the temperature from 10° to 30° is given by the equation $E_t = 0.67179 - 0.000074(t - 18^\circ) - 0.0000015(t - 18^\circ)^2$. The *E.M.F.* increases on dilution, reaching in $N/10\text{-CdCl}_2$ solution a value of 0.7447 volt at 18° . The temperature-coefficients of cells with dilute solutions are positive, and increase with the dilution. For the same current, elements with concentrated solutions are more polarised than elements with more dilute solutions. In the former, however, the depolarisation is much more rapid. The cells are constant in value, and not altered by shaking.

When cadmium bromide replaces the chloride, the *E.M.F.* falls to 0.5592 volt, and the temperature-coefficient becomes five times as great. The cadmium iodide cell has E_{18} 0.4147 volt. Cadmium sulphate cells have an *E.M.F.* of 1.0186 volts at 20° and the lowest temperature-coefficient of any cadmium cell.

There is very close agreement between the thermodynamical calculation of the heat liberation in these cells and the values determined calorimetrically. For cadmium chloride they are respectively 31,993 cal. (calculated), 31,984 cal. (found). E. F. A.

Gas-Electrode for General Use. GEORGE S. WALPOLE (*Biochem. J.*, 1913, 7, 410—428).—The apparatus and technique are described of an electrode for determining the hydrogen-ion concentration of protein solutions often containing dissolved carbon dioxide, within a few minutes and correct to 1 millivolt with 1 or 2 c.c. of fluid without loss or contamination. Sørensen titrations of 4% Witte peptone both colorimetrically and electrometrically are described.

E. F. A.

Mineral Electrodes. ROGER C. WELLS (*Eighth Inter. Cong. App. Chem.*, 1912, 21, 149—154).—Although it is known that pyrolusite, magnetite, and pyrite are conductors of electricity, it does not seem to have been recognised that some other sulphides are even better conductors than pyrite, and can therefore serve as electrodes. An account is now given of certain phenomena which have been observed when conducting minerals function as electrodes in aqueous solutions. The minerals studied, in the approximate order of their conductivity, are galena, pyrrhotite, magnetite, chalcopryrite, and pyrite. Some of these develop potentials comparable with those shown by metals in contact with solutions of their salts. The potential is considerably affected by a change in the acidity or alkalinity of the solutions. Pyrite and marcasite are most positive in acid solutions; the potential falls as the solution becomes alkaline, and may even become negative in alkali sulphide solutions.

E. G.

The Product of an Electrolytically Disintegrated Carbon Anode, and the Existence of Colloidal Carbon. BARTOLO L. VANZETTI (*Kolloid. Zeitsch.*, 1913, 13, 6—9).—The author has prepared a quantity of the disintegration product by passing a current of 4 amps. per sq. dcm. through a dilute solution of sulphuric acid by means of carbon poles, which had been previously heated to 1000° in chlorine. On heating, the substance gives rise to water, carbon dioxide, and carbon monoxide. It is soluble in alkaline solutions, producing stable suspensoids which are precipitated by acids. The colloid wanders to the negative electrode when electrolysed between platinum electrodes. The author discusses the evidence for and against the product being colloidal carbon or an organic substance of acid or phenolic nature. It is shown that there is not sufficient evidence to warrant a conclusion, but that there is no evidence which makes the idea of a colloidal solution of carbon impossible. J. F. S.

The Hall Effect in Liquid Electrolytes. A. E. OXLEY (*Proc. Roy. Soc.*, 1913, A, 88, 588—604).—The author has examined solutions of copper sulphate, silver nitrate, and cadmium sulphate, and a gelatin solution of copper sulphate under the influence of direct and reversed magnetic fields. The method adopted differs from that usually employed in the facts that the cells were very small in comparison with the pole pieces of the magnet, and a very sensitive Paschen galvanometer was employed. It is shown that in the experiments the effect observed is due largely to the Hall concentration effect, and that only a small portion is due to the true Hall effect. The potential differences in all the experiments are of the calculated order; they reverse with the magnetic field, and act in the same direction when the experimental conditions vary widely. The results are regarded as establishing the existence of a Hall effect in liquid electrolytes. J. F. S.

Co-precipitation of Copper and Carbon by Electrolysis: Oxidation at the Cathode. ELLWOOD B. SPEAR, C. CHOW, and A. L. CHESLEY (*Eighth Inter. Cong. App. Chem.*, 1912, 21, 93—97).—Lambris (A., 1910, ii, 131) has demonstrated the presence of carbon in the deposits obtained by the electrolysis of iron and nickel solutions, but has stated that, in the case of copper solutions, carbon is not precipitated under the same experimental conditions.

In the present paper, experiments are described which show that carbon is precipitated at the cathode during the electrolysis of a copper sulphate solution containing a little nitric acid and a small quantity of gelatin, and that some of the carbon is in the free state. It is considered that an oxidising action takes place at the cathode, and is doubtless due to secondary reactions. E. G.

Function of Inorganic Additive Agents in the Electrolytic Deposition of Copper. ELLWOOD B. SPEAR (*Eighth Inter. Cong. App. Chem.*, 1912, 21, 99—103).—In the electrolysis of copper solutions, the addition of certain inorganic substances under suit-

able conditions produces a beneficial effect on the deposition of the metal. The substances which have the greatest influence are nitric, hydrochloric, and sulphuric acids, and the nitrates and chlorides of ammonium and the alkali and alkali earth metals. It is suggested that the function of such agents is to keep the copper in solution. This theory is based on the assumptions that some particles of copper may assume the colloidal form at the moment of giving up their electric charges at the cathode, and that oxidation may take place on the cathode during the passage of the current. Experiments are described which show that copper is continuously dissolved and reprecipitated at the cathode during the electrolysis. The theory affords an explanation of the fact that good deposits of copper become loose and worthless if the electrolysis is continued too long.

E. G.

Present Theory of Magnetism and the Periodic System of Chemical Elements. JAKOB KUNZ (*Eighth. Inter. Cong. App. Chem.*, 1912, **22**, 187—203).—A discussion of the electron theory of magnetism with special reference to Langevin's kinetic hypothesis of dia- and para-magnetism. It is shown that the phenomena are more complicated than Langevin's theory indicates, and that certain elements seem to exist in both the diamagnetic and paramagnetic state. A certain periodicity is pointed out between the atomic weights of the elements and their magnetic properties. A modification of the theory with regard to the difference between diamagnetic and paramagnetic properties is proposed. Ferromagnetism is discussed chiefly on the basis of Weiss's work, and particular attention is devoted to Weiss's magneton (A., 1911, ii, 183, 367, 694).

E. G.

Magnetic Researches. VIII. The Susceptibility of Gaseous Oxygen at Low Temperatures. H. KAMERLINGH ONNES and E. OOSTERHUIS (*Proc. K. Akad. Wetensch. Amsterdam*, 1913, **15**, 1404—1406).—The magnetic susceptibility of gaseous oxygen is determined between the temperatures of 17° and -126.7° at 100 times the normal density. It is shown that a Δ does not appear in oxygen above the critical temperature when the densities are 100 times the normal value. From this it appears probable that a Δ only appears for oxygen at great densities, and that in liquid oxygen it can rise to 71° as the density approaches 1000 times the normal value.

J. F. S.

Magnetic Investigation of Some Iron Compounds. W. HAGEN (*Kolloid Zeitsch.*, 1913, **13**, 4—6).—The magnetic susceptibilities of a number of iron compounds have been determined, and the following relative values obtained: Ferric chloride, 1.000; ferric oxide, 0.116; iron formate, 0.784; iron acetate, 0.553; basic iron acetate, 0.540; iron valerate, 0.459; iron lactate, 0.810; iron malate, 0.675; iron tartrate, 0.634; iron citrate, 0.493; and iron saccharate, 1.010. Solutions of these compounds have been examined in the same way, and it is shown that they are mostly hydrolysed in solution, the

formate most strongly, and the citrate and malate only to the smallest extent. The formate and acetate contain all the iron in a colloidal condition in solution, and from the magnetic susceptibility it is shown that, in addition to colloidal hydroxide, another colloidal iron compound is present. The susceptibility of iron acetate and formate solutions increases with time, and eventually reaches a constant value, whilst the electric conductivity decreases to a constant value. On diluting ferric chloride with water, the hydrolysis increases with the dilution; sucrose solution and glycerol have the same effect, but dextrose and levulose solutions decrease the hydrolysis. J. F. S.

Decomposition of Complicated Chemical Compounds in a Variable Magnetic Field. ROMAN CEGIELSKI and, in part, E. L. LEDERER (*Ber., Deut. physikal. Ges.*, 1913, **15**, 566—570).—Rosenthal (A., 1908, ii, 152) has shown that starch, sucrose, and certain proteins can be hydrolysed when a solution is placed in a continuously varying magnetic field. The authors have repeated these experiments, taking care to sterilise the solutions and containing vessels before the experiments. In no single case when the solutions were sterilised could hydrolysis be observed. In two cases, however, the solutions were not sterilised, and in these cases starch solutions were hydrolysed. J. F. S.

The Heat Theorem of Nernst. HENDRIK A. LORENTZ (*Chem. Weekblad*, 1913, **10**, 621—627).—A theoretical paper embodying applications of Nernst's theorem. A. J. W.

Allotropy of Iron and Silver Iodide. CARL BENEDICKS (*Eighth Inter. Cong. App. Chem.*, 1912, **22**, 13—27).—An allotropic change is not necessarily a sudden transformation of one modification into another, since there is always the possibility that one or both forms may have a certain solubility in the other, and in such cases the transformation in part takes place continuously.

Determinations of the dilatation of silver iodide from -180° to $+200^{\circ}$ have shown that the transformation point of this substance at about $+147^{\circ}$ affords an illustration of this fact. At low temperatures the dilatation is positive, but at 0° or the ordinary temperature it is negative. The dilatation must be ascribed to a solubility of the regular modification, stable above the transition point, in the hexagonal modification; this solubility increases with the temperature, and according to the curve of dilatation is probably very limited.

Consideration of the critical transformation point, A_3 , of iron at about 890° , and of the lower more undecided transformation range, A_2 , shows that the transformation at 890° is of the same type as that of silver iodide. According to this view, the so-called β -iron is really α -iron (stable at low temperatures), containing in solution a limited amount of γ -iron, increasing with the temperature (stable at temperatures above 890°). This conception greatly simplifies certain questions relating to the metallography of iron.

For example, the three most probable theories for the constitution of martensite when regarded from this point of view become identical. E. G.

Contractive Volume- and Surface-Energy and Thermal Condition of Matter. PETR. P. VON WEIMARN (*Kolloid. Zeitsch.*, 1913, 13, 16—19).—A theoretical paper in which the author advances the view that the thermal condition of a substance is dependent on its dispersity. In considering the thermal condition of a solid substance, three surfaces have to be considered: (1) The outside surface, which bounds the substance from the surrounding objects; (2) the inner surface of contact of the crystalline particles; and (3) the inner pulsating surface of the crystalline particles.

J. F. S.

Thermal Properties of Carbonic Acid at Low Temperatures. C. FREWEN JENKIN and D. R. PYE (*Phil. Trans.*, 1913, A, 213, 67—117).—The thermal properties of carbon dioxide, liquid and gaseous, have been determined over the temperature range -50° to $+20^{\circ}$. The thermal quantities determined include: latent heat, total heat of the liquid, specific heat of the gas, dilation and elasticity of the liquid, and the Joule-Thomson effect for the liquid. From the experimental quantities, the specific volume and density of the saturated vapour and the specific heat of the liquid at constant pressure have been calculated. The pressure-temperature curve for the saturated vapour, and the entropy-temperature curve for the range $+20^{\circ}$ to -50° have been constructed. The following values of the specific heat of the gas have been obtained over the temperature ranges indicated, the former temperature being that at the commencement of the experiment, and the latter at the end of the experiment: -30.4° to $+7.8^{\circ}$, 0.22; -22.4° to $+8.6^{\circ}$, 0.25; -13.0° to $+11.2^{\circ}$, 0.275; -1.9° to $+9.1^{\circ}$, 0.32; $+8.3^{\circ}$ to 19.5° , 0.41; 14.9° to 25.6° , 0.435; 20.4° to 30.5° , 0.495; 24.6° to 35.4° , 0.55. The latent heat has a value 81.2 at -53.4° , which decreases to 36.56 at $+20.05^{\circ}$. The specific heat of the liquid at constant pressure has the value 0.47 at -50° , and 0.68 at $+20^{\circ}$. The value of the Joule-Thomson temperature change alters its sign at about -30° , being negative from 10° to -30° , and becoming positive at this point. J. F. S.

Capacity for Heat of Metals at Different Temperatures. ERNEST H. GRIFFITHS and EZER GRIFFITHS (*Proc. Roy. Soc.*, 1913, A, 88, 549—560 *).—The authors have determined the specific heats of copper, aluminium, iron, zinc, silver, cadmium, tin, and lead at temperatures from 0° to 100° . The experiments were carried out with large quantities of the metals (1—3 kilos.), and the temperature differences never amounted to more than 1.4° . The temperature readings were made by means of platinum resistance thermometers. The specific heat of the metals examined at 0° bear the relationship to their atomic weights represented by $S = 4.804 \times a^{-0.95}$, in which S represents the specific heat, and a the

* and *Phil. Trans.*, 1913, A, 213, 119—185.

atomic weight. By extrapolation the authors deduce that the atomic heat of the metals at absolute zero has a mean value of 4.813.
J. F. S.

New Method of Measuring the Pressure of Corrosive Gases at Constant Volume. GEORGE S. FORBES and LESLIE BRIGGS COOMBS (*Eighth Inter. Cong. App. Chem.*, 1912, 22, 79—85).—The determination of the pressure of corrosive gases at constant volume and high temperatures presents considerable difficulty, and the methods described hitherto are not satisfactory. Apparatus has therefore been devised which can be readily constructed. The pressure gauge is outside the oven, and is easily manipulated, and does not require calibration.

The apparatus consists of a glass bulb of about 250 c.c. capacity which has a small closed tube at the bottom and a tube at the top which carries a side-tube bent so as to emerge from the electric oven in which the bulb is heated. The tube, after leaving the oven, is bent horizontally and wound closely with fine nichrome ribbon to a point a little beyond the second of two depressions it bears. The first of these depressions is filled before the determination with a mixture of powdered fused lead and silver chlorides in molecular proportions. This mixture melts at about 350°. The tube is constricted at a point a little beyond the second depression, and the volume of the further portion is reduced by the introduction of a piece of glass rod. A piece of vacuum tubing connects the end of the tube with a section of thermometer tubing, and contains a smooth glass bead, which acts as an airtight seal unless the tubing is pinched at this point. By this means any rapid flow of air in either direction is prevented. At the end of the thermometer tubing where it is joined to the manometer is a fine capillary, which can be broken and re-sealed in order to admit air or to expel it from this part of the apparatus. The manometer is provided with a flexible tube, which enables the open arm to be raised or lowered at will to adjust the pressure.

If the pressure of the vapour of a liquid, such as phosphoryl chloride, or of a solid, such as iodine, is to be measured, a weighed quantity is sealed in a capsule of glass tubing provided with a very fine, closed capillary, and this capsule is inserted into the small closed tube at the bottom of the bulb. The bulb is then rendered nearly vacuum, and the upper end of the tube at the top of the bulb is sealed off. The mixed chlorides in the depression in the horizontal tube are fused by means of a small flame, and the tube is inclined by raising the bulb. The liquid flows towards the second depression, and forms a drop about 1 cm. long. A current just sufficient to keep it fused is passed through the nichrome ribbon. The drop readily responds to pressure changes of 0.1—0.2 mm. in the manometer, and thus enables the pressure in the bulb to be equated exactly to that in the manometer. The capsule is broken by means of gentle shaking at a temperature at which its vapour pressure does not exceed the pressure of the residual air in the bulb.

If a gas is to be investigated, it is admitted slowly into the vacuous bulb through a well-ground stopcock, and the drop is kept stationary in the tube by forcing in the requisite amount of air through the vacuum tubing.

The mode of calculating the results is explained, and experiments are described which demonstrate the practicability of the method.

E. G.

Vapour Pressure of Zinc Amalgams. JOEL H. HILDEBRAND (*Eighth Inter. Cong. App. Chem.*, 1912, 22, 147—156).—A study of the vapour pressure of amalgams has been undertaken with the object of testing the vapour pressure law on solutions differing widely in physical nature from the organic mixtures to which it has hitherto been applied, and also of investigating the general problem of metal compounds from a new point of view.

The results of some measurements of the vapour pressure of zinc amalgams are recorded. The values of the relative vapour pressures, P , of the amalgam and, P_0 , of mercury are plotted against $N/N+1$, where N represents the number of mols. of mercury per mol. of zinc. If the amalgams were perfect solutions and obeyed the law $P/P_0 = N/N+1$, the curve should be a straight line, and the values $N/N+1$ and P/P_0 should agree. The results show, however, that the pressures are considerably higher than they should be for a simple solution. This divergence is explained by assuming that the solute is associated to some extent, and hence the number of mols. of zinc is less than is assumed in the simple formula. If the zinc was partly associated thus, $2\text{Zn} = \text{Zn}_2$, and α represents the number of mols. of Zn_2 formed from 1 mol. of Zn, there would remain $1-2\alpha$ mols. of Zn, and the total number of mols. present in the mixture would be $N+1-\alpha$. The values of $N/N+1-\alpha$, calculated from the law of mass action, agree closely with the observed values of P/P_0 , and thus indicate that the assumptions involved are correct. The extent of the association at various concentrations has been calculated, and it is shown that if zinc could exist in the liquid state at 300° , it would be associated to Zn_2 to an extent of two-thirds.

E. G.

Vapour Pressures of Some Concentrated Zinc Chloride Solutions. ALAN W. C. MENZIES and HENRIK BOVING (*Eighth Inter. Cong. App. Chem.*, 1912, 22, 219—220).—Determinations of the vapour pressures of zinc chloride solutions have given the following results, expressed in mm. of mercury at 0° : 60% solution, 4.4 at 14.64° , 8.1 at 24.64° , and 10.8 at 29.60° ; 65% solution, 2.5 at 14.64° , 5.0 at 24.64° , and 6.9 at 29.60° ; 70% solution, 1.4 at 14.64° , 2.9 at 24.64° , and 4.1 at 29.60° .

E. G.

The Rate of Evaporation of Liquids. PAUL DE HEEN (*J. Chim. phys.*, 1913, 11, 205—213. Compare Jablczynski and Przemyski, A., 1912, ii, 908).—In the author's measurements (1891) a stream of gas was allowed to impinge normally on the surface of a liquid, and the rate of evaporation was proportional to the product of the vapour tension and the internal friction of the gas. In Jablczynski

and Przemyski's recent experiments, the stream of gas was practically tangential to the surface of the liquid. Under these conditions a stationary saturated gaseous diffusion layer is formed, and the laws of evaporation are profoundly modified. Thus the relative rates of evaporation of water in hydrogen and in air are opposite in the two kinds of experiment.

Both normal and tangential gas streams were employed by the author in 1891, and Jablczyński and Przemyski's results are in better accord with the laws then established the more nearly their experimental conditions approximate to his. R. J. C.

Thermal Analysis. FRANCESCO OLIVARI (*Chem. Zentr.*, 1913, i, 2001; from *Rendiconti Soc. Chim. Ital.*, 1911, 5).—Rudolfi (A., 1909, ii, 536) found no halt points in certain binary mixtures of organic compounds, and inferred partial isomorphism. Such points are now shown to exist in some of his cases. In the case of the system *m*-dinitrobenzene-naphthalene, an equimolecular compound exists which is strongly dissociated in the fused mass. A mathematical consideration is elaborated for the existence of compounds in the liquid phase which cannot be separated in the solid state.

E. F. A.

Heat of Formation of the Oxides and Sulphides of Iron, Zinc, and Cadmium. Heat of Combination of Acidic Oxides with Sodium Oxide. IX. WILLIAM G. MIXTER (*Amer. J. Sci.*, 1913, [iv], 36, 55—69. Compare A., 1912, ii, 899, and earlier abstracts).—The results of this work may be summarised as follows: $\text{Fe} + \text{O} = \text{FeO} + 64,300 \text{ cal.}$; $2\text{Fe} + 3\text{O} = \text{Fe}_2\text{O}_3 \text{ (faint red)} + 192,200 \text{ cal.}$; $3\text{Fe} + 4\text{O} = \text{Fe}_3\text{O}_4 \text{ (magnetite)} + 265,700 \text{ cal.}$; $3\text{Fe} + 4\text{O} = \text{Fe}_3\text{O}_4 \text{ (fused)} + 265,200 \text{ cal.}$; $2\text{FeO} + \text{O} = \text{Fe}_2\text{O}_3 + 63,700 \text{ cal.}$; $2\text{Fe}_3\text{O}_4 + \text{O} = 3\text{Fe}_2\text{O}_3 + 54,500 \text{ cal.}$; $\text{FeO} + \text{Fe}_2\text{O}_3 = \text{Fe}_3\text{O}_4 \text{ (magnetite)} + 9200 \text{ cal.}$; $\text{Fe}_2\text{O}_3 + x\text{Na}_2\text{O} = \text{Fe}_2\text{O}_3 \cdot x\text{Na}_2\text{O} + 58,000 \text{ cal.}$; $\text{Fe} + \text{S} = \text{FeS (amorph.)} + 18,800 \text{ cal.}$; $\text{FeS (amorph.)} + \text{S} = \text{FeS}_2 \text{ (cryst.)} + 16,700 \text{ cal.}$; $\text{Zn} + \text{S (rhombic)} = \text{ZnS (cryst.)} + 41,300 \text{ cal.}$; $\text{CdO} + \text{Na}_2\text{O} = \text{Na}_2\text{CdO}_2 + 6500 \text{ cal. (approx.)}$; $\text{Cd} + \text{O} = \text{CdO (amorph.)} + 57,000 \text{ cal.}$; $\text{Cd} + \text{O} = \text{CdO (mostly cryst.)} + 63,000 \text{ cal.}$; $\text{Cd} + \text{S (rhombic)} = \text{CdS (cryst.)} + 34,000 \text{ cal.}$

Ferrous oxide can be obtained free from carbon or iron carbide by heating ferrous oxalate in a current of dry nitrogen. The temperature is gradually raised, until after four hours it is about 520° and carbon dioxide has ceased to be evolved. The temperature is then raised to 900° , and maintained at this point for an hour. The product thus obtained appears to be a mixture of FeO (4 mols.) and Fe (1 atom).

Reddish-brown, amorphous cadmium oxide volatilises or dissociates slowly at 900 — 1000° , but the rate of loss diminishes as the oxide becomes denser and crystalline. E. G.

The Heats of Formation of Some Silicates of Iron and Manganese. S. WOŁOGDINE (*Compt. rend.*, 1913, 157, 121—123).—The author has determined the heats of formation of silicates of

iron and manganese, starting with pure quartz and ferrous oxide and manganous carbonate respectively. The figures he obtained for the molecular heats of formation are, for FeO, SiO_2 , 5905 cals., and for MnO, SiO_2 , 7725 cals., allowance being made in the latter case for the heat of dissociation of the manganous carbonate with formation of the oxide.

W. G.

Relation Between the Thermal Effect which Accompanies the Immersion of Dry, Powdered Substances in Liquid Substances and the Aptitude of the Latter to Form Associated Molecules. HENRY GAUDECHON (*Compt. rend.*, 1913, 157, 209—211).—The author has determined the amount of heat evolved per gram of dry powder on plunging a dried, powdered substance into a liquid without action on it. Four powders were used, and numerous liquids were examined. From the results the liquids arrange themselves in much the same order as from a study of the Pictet-Trouton coefficient LM/T , or the Ramsay-Shields coefficient K . The more abnormal the liquid with respect to these two laws, the more heat is evolved in the experiment. With normal liquids, the thermal effect is practically zero. From the results, it appears that the thermal effect depends principally (1) on the abnormal nature of the liquid; (2) on the area of the solid surface with respect to the weight of the solid, the greater part of the thermal effect being attributable to the aggregation or polymerisation of the molecules of the liquid at the surface of the solid.

W. G.

Characterisation of Flame. NICOLAE TECLU (*J. pr. Chem.*, 1913, [ii], 88, 189—192).—The author criticises the use of the term “flameless combustion” in connexion with the surface combustion of inflammable gaseous mixtures, and maintains that the combustion of the latter is invariably accompanied by the production of flame.

The invisibility of the flame in the surface combustion of inflammable gas mixtures is due to the luminosity of the flame being very feeble in comparison with that of the heated surface at which the combustion occurs.

F. B.

Two Small Corrections to be Applied to Densities of Gases Determined at Geneva. PHILIPPE A. GUYE (*J. Chim. phys.*, 1913, 11, 319—326).—Recent measurements of gaseous densities at Geneva by the bulb method have shown a variation of less than 1 in 10,000. In reducing the weighings to vacuum standard at sea level in latitude 45° the normal weight of 1 c.c. of air has been assumed to be 0.00117 gram, and the gravity constant 980.616, and the platinum fractions have been corrected to vacuum standard independently of the brass gram weights. The first correction is not justified without taking into account the pressure, temperature, and humidity of the air at the time of weighing, and as the platinum fractions are standardised in air against brass, the whole of the weights should be considered as brass in applying vacuum corrections. The necessity for vacuum corrections is largely avoided

if the uncorrected tare of the bulb under similar meteorological conditions is known.

The most recent determinations of the gravity constant at Geneva, made in 1894 by Messerschmitt, gave $g = 980.600$, corresponding with an error in the previous corrected values of $16/1,000,000$. A table is given of the total correction to be applied to various weights of gas on account of these considerations. The correction on 1 gram of gas, for instance, is 0.000068 gram, but there are other sources of error in bulb measurements which render these small corrections to some extent illusory. R. J. C.

Specific Gravity and Displacement of Some Saline Solutions.

JOHN Y. BUCHANAN (*Trans. Roy. Soc. Edin.*, 1912, **49**, 1—225).—An account is given of the determination of the specific gravity of solutions of the iodides, bromides, chlorides, nitrates, iodates, bromates, and chlorates of potassium, rubidium, and caesium at temperatures 15.0° , 19.5° , 23.0° , and 26.0° , the values being referred to water at the same temperatures as unit. Determinations were also made with solutions of sodium chloride, calcium chloride, magnesium chloride, and glucinum chloride. The concentrations of the solutions varied from solutions containing $1/1024$ of the gram-molecular weight in 1000 grams of water to those containing 9 gram-molecular weights in the same weight of water. In the case of the calcium chloride determinations, measurements were made with supersaturated solutions. All the determinations of solutions containing less than half molecular weight were made by specially prepared hydrometers, the more concentrated solutions were determined by means of a pycnometer, and for the supersaturated solutions the hydrometer was again used. A long description of the preparation of the hydrometer and its standardisation is given; this instrument resembles that used by the author on the *Challenger* Expedition. A description is also given of an open hydrometer for use with solutions of high specific gravity. The author considers the relationships between the displacement increments of analogous salts with change of concentration and the specific gravity of salts of nearly the same molecular weight, for example, RbCl, KBr, and $K(Cl+I)/2$, which are generally found to be very much alike. The specific gravity of solid potassium chloride, bromide and iodide, rubidium chloride, bromide and iodide, caesium chloride, bromide and iodide, potassium chlorate, bromate and iodate, rubidium chlorate, bromate and iodate, and caesium chlorate, bromate and iodate are also determined. This is effected by weighing the crystals in their own saturated mother liquor at the saturation temperature in a specific gravity bottle. The following values, compared with water at the same temperature, are obtained at temperatures 24.3 — 22.8° : KCl, 1.951; KBr, 2.679; KI, 3.043; RbCl, 2.706; RbBr, 3.210; RbI, 3.428; CsCl, 3.982; CsBr, 4.455; CsI, 4.508; KClO₃, 2.319; KBrO₃, 3.219; KIO₃, 3.924; RbClO₃, 3.176; RbBrO₃, 3.681; RbIO₃, 4.336; CsClO₃, 3.582; CsBrO₃, 4.109; and CsI, 4.849. The specific gravities of the solutions are given to six places of decimals,

and it is shown that in many cases there is a probable error of only one or two units in the sixth place. Finally a series of factors is given for converting the values of ρS_t to $_{40}S_t$. In the determination of the specific gravity of supersaturated solutions of calcium chloride, the values fluctuated a great deal owing to rapid internal changes of temperature, from which it is deduced that the solution is internally in a state of unrest, which the author compares to the state of a gas or liquid at the critical temperature when under a pressure greater than the critical pressure. J. F. S.

Viscosity of Gases at Low Temperatures. I. Hydrogen. H. KAMERLINGH ONNES, C. DORSMAN, and SOPHUS WEBER (*Proc. K. Akad. Wetensch. Amsterdam*, 1913, 15, 1386—1396).—The viscosity of hydrogen has been determined by the transpiration method from the temperature of solid carbon dioxide down to that of liquid hydrogen. The results are calculated on the basis of O. E. Meyer and Knudsen's formula. The results are recorded in a table along with those of Markowski and Kopsch (A., 1904, ii, 652). The value of $\eta \times 10^7$ is compared with the value calculated from Sutherland's formula, using the values $\eta_0 = 841.10$ and $C = 83$. It is shown that there is a very great divergence at the lower temperatures between the observed and calculated values, which amounts to more than 100% at the temperature of liquid hydrogen. The authors deduce the formula $\eta = \eta_0 (T/273)^{0.695}$ to represent the relationship between viscosity and temperature. This formula is applied to the present results and to those of Markowski and Kopsch (*loc. cit.*), and gives good agreement over the whole range of temperature. J. F. S.

Viscosity of Gases at Low Temperatures. II. Helium. H. KAMERLINGH ONNES and SOPHUS WEBER (*Proc. K. Akad. Wetensch. Amsterdam*, 1913, 15, 1396—1399. Compare preceding abstract).—The viscosity of helium is determined at temperatures from that of solid carbon dioxide to that of liquid helium by the transpiration method. The values of $\eta \times 10^7$ are given, and diverge widely from those calculated by the Sutherland formula. The relationship between viscosity and temperature is expressed by the formula $\eta/\eta_0 = (T/273.1)^{0.647}$, which gives calculated values agreeing over the whole temperature range with the experimental values. J. F. S.

Viscosity of Gases at Low Temperatures. III. Comparison of the Results Obtained with the Law of Corresponding States. H. KAMERLINGH ONNES and SOPHUS WEBER (*Proc. K. Akad. Wetensch. Amsterdam*, 1913, 15, 1399—1403. Compare preceding abstracts).—A theoretical paper, in which the dependence of viscosity on temperature is discussed. The viscosities of two mechanically similar systems are shown to give a constant ratio, which can be calculated from the expression $-\frac{1}{2} \log \eta / \sqrt{T} \sqrt{M} = \log \sigma - \log c$, in which M is the molecular weight, σ the mean radius of a molecule, and c a constant which is the same for all substances. J. F. S.

Method of Measuring the Viscosities of Vapours of Volatile Liquids, with an Application to Bromine. ALEXANDER O. RANKINE (*Proc. Roy. Soc.*, 1913, *A*, 88, 575—588).—The author, making use of O. E. Meyer's transpiration formula, has devised a method of determining the viscosity of vapours of volatile liquids. The apparatus consists of two U-tubes of about 2 mm. internal diameter connected at one end to a capillary tube of 0.018 cm. diameter and 39 cm. long. One U-tube is filled with the liquid under examination, and the apparatus is exhausted and sealed. The U-tubes are placed in baths at known temperatures, one to evaporate the liquid, and the other to condense it. The capillary is placed in a third bath, which represents the experimental temperature. Experiments were carried out with bromine at temperatures from 13° to 220°, and the viscosity was determined; this quantity increases with temperature, and has the values in C.G.S. units at 12.9°, 1.511×10^{-4} ; 65.8°, 1.705×10^{-4} ; 99.8°, 1.885×10^{-4} ; 139.8°, 2.079×10^{-4} ; 179.8°, 2.273×10^{-4} ; and 220.4°, 2.480×10^{-4} . The author is able to calculate his values from Sutherland's equation, and with the exception of two values at the lowest temperatures, to obtain very good agreement. The values agree well with those obtained by the author by another method (*A.*, 1912, ii, 332). J. F. S.

Determination of the Viscosity of Caoutchouc Solutions. PHILIP SCHIDROWITZ and H. A. GOLDSBROUGH (*Kolloid. Zeitsch.*, 1913, 13, 46—48).—Polemical. The authors criticise changes made in their method of viscosity determination by Fol (this vol., ii, 301). J. F. S.

Stalagmometric Studies of Solutions of Colloids and Crystalloids. I. L. BERCZELLER (*Biochem. Zeitsch.*, 1913, 53, 215—231).—The surface tensions of protein solutions which are sufficiently free from salts not to coagulate on heating, diminish strongly on boiling. On keeping, however, the surface tension increases again. The phenomenon can be explained on the assumption that a change in the size of the particles takes place. The surface tension of water is diminished by albumoses (Witte's or Grübler's peptone). These substances diminish the surface tension of a trypsin solution less than they do that of distilled water. The surface tension of a trypsin-albumose solution is not constant, but progressively increases on keeping, at first rapidly, then more slowly. The trypsin appears to form an unstable compound with the albumose, which is then hydrolysed. Pepsin acts in a manner similar to trypsin. During hydrolysis with trypsin and pepsin, the surface tension strongly diminishes, the amount of diminution running parallel with the amount of albumose formed. S. B. S.

Stalagmometric Studies of Solutions of Colloids and Crystalloids. III. L. BERCZELLER and L. CSÁKI (*Biochem. Zeitsch.*, 1913, 53, 238—255).—The authors confirm generally the results of Traube, who has shown that the addition of small quantities of

alkali to solutions of salts of alkaloids diminishes the surface tensions of the solutions, increasing at the same time the toxicities. With the aggregation of the alkaloid in colloidal solution, which takes place on keeping, and more rapidly on warming than in the cold, the surface tensions again increase, whilst the toxicity diminishes. The alkaloids of the morphine series are an exception to this rule, as this is probably due to the chemical constitution of the substance, which has some relation to the surface-tension effects. A similar effect to the majority of alkaloids is observed when salicylic acid is separated from its salts by means of acids. This, again, is probably due to the existence of the free acid in colloidal solution. The adsorption of alkaloids by various adsorbents from alkaline solutions was also studied. By adsorption of the colloidal substance, the surface tension of the solutions was increased.

S. B. S.

Stalagmometric Studies of Solutions of Colloids and Crystalloids. II. L. BERCZELLER (*Biochem. Zeitsch.*, 1913, 53, 232—237).—Pure caseinogen has no marked action on the surface tension of water. On boiling, however, the surface tension of water is diminished, and apparently a certain amount of hydrolysis takes place. If the caseinogen is dissolved in acids or alkalis, the surface tension of water is diminished considerably; the stronger the acid or alkali, the greater being the amount of diminution.

S. B. S.

Adsorption in Solutions, and the Chemical Processes Brought About Thereby. Adsorption in Aqueous Solutions of Potassium Dichromate and Potassium Chromate by Animal Charcoal. TADEUSZ ORYNG (*Kolloid. Zeitsch.*, 1913, 13, 9—14. Compare A., 1912, ii, 1145).—It is shown that potassium dichromate is strongly absorbed by animal charcoal, and that the absorption consists mainly in the absorption of $\text{H}_2\text{Cr}_2\text{O}_7$, which is probably converted into chromic hydroxide by reaction with the charcoal. It is found that after shaking for five minutes the $\text{Cr}_2\text{O}_7^{--}$ concentration has decreased by 17.99%, and the K^+ concentration by 3.2%. The adsorption is much increased by the presence of 0.1*N*-hydrochloric acid, and in this process chromic ions are found in the solution. Sodium hydroxide retards the adsorption, and when the concentration 0.3*N* is reached entirely prevents it. This is attributed to the conversion of the dichromate into chromate, which, the author shows, is not adsorbed at all.

J. F. S.

Negative Adsorption. TADEUSZ ORYNG (*Kolloid. Zeitsch.*, 1913, 13, 14—16. Compare preceding abstract).—It is shown that on shaking potassium dichromate containing 0.3*N* NaOH with purified animal charcoal, an increase in the concentration amounting to 6.5% occurs. This increase is independent of the time of shaking, and is uninfluenced by the addition of 1.2—0.15 molar sodium hydroxide, but more dilute solutions cause a positive adsorption. The amount of negative adsorption increased in proportion to the

amount of charcoal used. The change is explained by the assumption that there is an increased water concentration on the surface layer. J. F. S.

Colloidal Constituents of Clay. PAUL ROHLAND (*Kolloid. Zeitsch.*, 1913, **13**, 62—63).—The author advances evidence to show that the absorption of organic colouring matters is dependent on their structure. Those dyes derived from azo- or diazo-compounds are but slightly adsorbed by alumina. Thus it is shown that to absorb 0.003 gram of the following dyes, different quantities of alumina are required. Aniline-blue, victoria-blue, violet, and diamond-green require 5 grams; orange and vesuvine, 10 grams; and metanil-yellow, 30 grams. The yellow dye substance contained in the wash water of the sulphite cellulose manufacture is not absorbed at all.

J. F. S.

Kinetic Theory of Osmotic Pressure. GUSTAV JÄGER (*Ann. Physik*, 1913, [iv], **41**, 854—865).—The author has deduced from the analogy between a gaseous mixture of a compressed gas containing a small quantity of a second gas, and a solution, a kinetic theory of osmotic pressure, and from this developed mathematically the usual expressions for osmotic pressure and lowering of the freezing point of solutions.

J. F. S.

The Strenuous Period in the Development of the Theories of Solution. SVANTE ARRHENIUS (*Chem. Weekblad*, 1913, **10**, 584—599).—An interesting autobiographical sketch, including an account of the evolution of the ionic theory, and of the criticism it evoked.

A. J. W.

Classification of the Colloids. RICHARD ZSIGMONDY (*Eighth Inter. Cong. App. Chem.*, 1912, **22**, 263—274).—The various ways which have been proposed for classifying the colloids are reviewed, and a new scheme is put forward based on the behaviour of the colloid solutions on evaporation to dryness. The colloids are divided into (1) "resoluble" colloids, which, on evaporation of their solutions, yield a residue completely soluble in the dispersion medium, and (2) "irresoluble" colloids, which furnish a partly or completely insoluble residue owing to the occurrence of irreversible changes of state during the drying process. The first class is subdivided into (a) those which require the application of heat for the preparation of solutions, such as gelatin, starches, agar-agar, and many soaps, and (b) those which do not require to be heated, such as dextrin, gum arabic, Paal's colloidal metals, Graham's tungstic and molybdic acids, molybdenum-blue, and albumin. The irresoluble colloids are also of two kinds: (a) those which during drying yield pulverulent precipitates which are no longer peptisable, including pure metal colloids, certain sulphides, and salts, such as silver bromide and chloride, and (b) those which suffer an irreversible transformation on drying, and give peptisable jellies, such as stannic acid, silicic acid, and ferric oxide.

The classification of dispersed systems is also discussed. E. G.

Influence of Surface-active Substances on the Stability of Suspensoids. HUGO R. KRUYT (*Proc. K. Akad. Wetensch. Amsterdam*, 1913, 15, 1344—1349).—The influence of *isoamyl* alcohol, *isobutyl* alcohol, propyl alcohol, and ethyl alcohol on the limitation value of the absorption value of arsenic sulphide sols for barium chloride is investigated. The sol is shaken with the organic solvent, and then with sufficient barium chloride solution, so that the sol shall not be completely coagulated. The concentrations are found to increase with increasing concentration of the alcohol, that is, the limitation value is increased. The greatest increase is observed in the case of *isoamyl* alcohol, the others being, in decreasing order, *isobutyl* alcohol, propyl alcohol, and ethyl alcohol. This order is the same as that in which the substances reduce the surface tension of water. Some preliminary experiments with phenol are described which comes between *isobutyl* alcohol and propyl alcohol in its action. J. F. S.

The Formula Expressing the Reduction in the Value of the Quantity b in the Equilibrium Equation with Diminution of Volume. JOHANNES D. VAN DER WAALS (*Chem. Weekblad*, 1913, 10, 628—634).—A theoretical paper. A. J. W.

Equilibria in Ternary Systems. VI. FRANS A. H. SCHREINEMAKERS (*Proc. K. Akad. Wetensch. Amsterdam*, 1913, 15, 1298—1312).—A theoretical paper, in which the considerations of the previous papers are continued for the complex, solid-gas. The various transformations of the system are considered. J. F. S.

Equilibria in Ternary Systems. VII. FRANS A. H. SCHREINEMAKERS (*Proc. K. Akad. Wetensch. Amsterdam*, 1913, 15, 1313—1326. See preceding abstract).—A theoretical paper, in which the behaviour of the systems containing two solid phases is considered under various changes of external conditions. J. F. S.

Equilibria in Quaternary Systems. IX. Quaternary Systems with Ternary Mixed Crystals with a Gap of Miscibility. NICOLA PARRAVANO (*Gazzetta*, 1913, 43, i, 594—608. Compare this vol., ii, 571).—A mathematical discussion of this subject. R. V. S.

Intramolecular Transformations. VI. Influence of the Solvent on the Equilibrium and the Velocity of Transformation. OTTO DIMROTH (*Annalen*, 1913, 399, 91—119).—The author has previously shown, by experiments on the methyl and ethyl esters of 5-amino-1-phenyl-1:2:3-triazole-4-carboxylic acid and their intramolecular transformation products, methyl and ethyl 5-anilino-1:2:3-triazole-4-carboxylates, that the displacement of the state of equilibrium, which a chemical system experiences through the influence of the solvent, is not dependent on any physical constant of the solvent, but is related to the solubilities of the reacting molecules. This relation is expressed by the

equation $c_A/c_B = Kl_A/l_B$, where c_A and c_B are the concentrations of the two modifications in the state of equilibrium, l_A and l_B are the solubilities, and K is a constant which is independent of the nature of the solvent

In order to verify this important relation and to widen the region of its applicability, two other pairs of structural isomerides have been examined, namely, methyl 5-hydroxy-1-methyl-1:2:3-triazole-4-carboxylate and methyl diazomalonmethylamide, and the ketonic and enolic modifications of benzoylcamphor. In the former pair of isomerides, in methyl alcohol, benzyl alcohol, acetone, ethyl acetate, ethyl nitrate, and nitrobenzene at 18° , although c_A/c_B (where A denotes the neutral isomeride, methyl diazomalonmethylamide) varies between 3.27 and 99 and l_A/l_B between 6.29 and 171.3, the value of K only varies between 0.52 and 0.68. This variation from constancy is attributed to the errors unavoidably introduced, partly by the enormously great solubility of the neutral isomeride as compared with that of the acidic form, partly by the fact that the value of c_A/c_B at 18° can only be obtained by extrapolation, the time required to attain equilibrium being thirty to forty days even at a temperature as high as 50° .

Similarly with the two forms of benzoylcamphor at 0° in ether, ethyl acetate, ethyl alcohol, methyl alcohol, and acetone, c_A/c_B (where A denotes the enolic modification) varies between 0.852 and 6.81, l_A/l_B between 0.748 and 6.39, and K between 1.06 and 1.15. The two varieties of benzoylcamphor are obtained by modifications of Forster's method (T., 1901, **79**, 987); the ketonic form has m. p. 112° (Forster, $87-88^\circ$), and the enolic form, $90-91^\circ$ (Forster, 89°).

Since $c_A/c_B > l_A/l_B$ at 0° , it follows that enolic modification of benzoylcamphor is stable in the crystalline state. This is verified experimentally by dilatometric method, whereby it is shown that the ketonic form changes to the enolic by long keeping. The transition temperature at which $c_A/c_B = l_A/l_B$, and therefore $K=1$, in other words, the temperature at which both forms can co-exist in the crystalline state, cannot be determined experimentally, but lies below -10° .

The author offers some interesting remarks concerning the relations between the solubilities and the constitutions of organic substances. These remarks can only be mainly speculations in the present state of our knowledge, but the author suggests that the solubility is a constitutive property in the sense that it is the product of factors each of which corresponds with each of the atomic groupings of which the molecule is composed. C. S.

System Oxalic Acid, Ammonium Oxalate, and Water at 30° and 45° . HERMAN W. WOODSTRA (*Eighth Inter. Cong. App. Chem.*, 1912, **22**, 251—257).—Three well-defined ammonium oxalates are known, namely, the normal oxalate, $C_2O_4(NH_4)_2 \cdot H_2O$, the hydrogen oxalate, $CO_2H \cdot CO_2 \cdot NH_4 \cdot H_2O$, and the tetroxalate, $C_2O_4H_2 \cdot CO_2H \cdot CO_2 \cdot NH_4 \cdot 2H_2O$. The equilibria have been studied which occur when mixtures of oxalic acid and ammonium oxalate

in different proportions are shaken with water at constant temperatures.

The isotherms of the system ammonium oxalate, oxalic acid, and water have been determined at 30° and 45°. The solubilities of oxalic acid at these temperatures are 12.59 and 21.015 grams respectively in 100 grams of solution, and those of normal ammonium oxalate are 5.53 and 8.3 grams respectively in 100 grams of solution. A saturated solution of normal ammonium oxalate deposits the tetroxalate both at 30° and at 45°. Graphical determinations of the solubility of the tetroxalate have shown that it is soluble to the extent of 7.21 grams in 100 grams of solution at 30°, and 11.12 grams at 45°. E. G.

Applications of the Partition Law. WALTHER HERZ and W. RATHMANN (*Zeitsch. Elektrochem.*, 1913, **19**, 552–555).—The partition coefficient of bromine, iodine, phenol, and acetone is determined between water and a number of aliphatic chlorinated hydrocarbons. From the results of the experiments at 25°, it is shown that bromine and iodine have normal molecular weights in tetrachloroethane, pentachloroethane, trichloroethylene, and tetrachloroethylene. Phenol is bimolecular in chloroform, tetrachloroethane, pentachloroethane, trichloroethylene, and tetrachloroethylene, and exists as bi- and ter-molecular complexes in carbon tetrachloride. Acetone is bimolecular in carbon tetrachloride and tetrachloroethylene, unimolecular in trichloroethylene, and forms complexes with chloroform pentachloroethane and tetrachloroethane. J. F. S.

Gradual Hydrolysis. II. CARL L. WAGNER (*Monatsh.*, 1913, **34**, 931–948. Compare this vol., ii, 200).—The author has examined dilute solutions of ferric chloride by means of an ultramicroscope, with and without the presence of potassium sulphate. It is shown that the gradual hydrolysis, as followed under the microscope, confirms the hypothesis put forward (*loc. cit.*) with regard to the gradual increase in the electric conductivity of ferric chloride solutions. The ratio between the surface of the colloidal particles at $t=0$ and $t=15$ is calculated, and this value agrees well with the corresponding ratio obtained from the electric conductivity. Similar experiments were carried out with zirconium nitrate, and the results obtained were found to be analogous to those obtained for ferric chloride. J. F. S.

Studies in the Speed of Reduction. MORRIS LOEB (*Eighth Inter. Cong. App. Chem.*, 1912, **26**, 601–604).—A study has been made of the effect of aluminium chloride on the behaviour of ferric chloride towards stannous chloride by a method similar to that employed by Noyes (A., 1895, ii, 257; 1897, ii, 17) in his investigation of the rate of reaction between ferric chloride and stannous chloride, and has shown that the rate of reaction between the two salts in $N/20$ -concentration is more than doubled when aluminium chloride is present in $N/20$ -concentration, whilst in presence of $N/10$ -aluminium chloride the rate is quadrupled. Manganous

chloride and glucinum chloride in $N/20$ -concentration also double the speed of the reaction, whilst a $N/20$ -quadrivalent thorium solution does not cause so great an acceleration.

When a solution of ceric sulphate is left under ordinary conditions, it gradually undergoes reduction to the cerous state. The rate of reduction is increased by dextrose, but the reaction does not follow a logarithmic law, the amount of cerium reduced being simply proportional to the time. When lanthanum sulphate or thorium sulphate is added to the ceric solutions, they exert an unmistakable influence on the rate of reduction by dextrose.

The variation in the velocity of these reactions seems to be due to a specific influence of the metals concerned, and probably indicates the formation of complex bases. E. G.

Contributions to the Chemical Kinetics of Enzymes. KIKUNAË IKEDA (*Eighth Inter. Cong. App. Chem.*, 1912, **22**, 157—167).—The exact study of enzyme actions is rendered difficult owing to the gradual decay of the enzyme during the course of the experiments. Certain problems relating to the decay of the enzyme in the presence of the substratum are now discussed from a theoretical point of view. The case in which the velocity of the destruction of the enzyme is proportional to that of the transformation of the substratum is considered in detail, and certain deductions are made which are confirmed by Yamasaki's work on catalase.

The problem of the optimum temperature is also dealt with, and the relation between this temperature and the temperature-coefficient of the decay of the enzyme is elucidated. E. G.

Catalytic Studies. IV. H^+ -ion Catalysis and Autocatalysis of the Modified Hydrogen Peroxide-Thiosulphate Reaction. EMIL ABEL (*Monatsh.*, 1913, **34**, 821—881. Compare this vol., ii, 399).—It is shown that the reaction between hydrogen peroxide and sodium thiosulphate in the presence of molybdic acid yields sulphate instead of tetrathionate according to the equation $4H_2O_2 + S_2O_3^{2-} \rightarrow 2SO_4^{2-} + 2H^+ + 3H_2O$. This reaction is accelerated by H^+ ions in proportion to their concentration. The coefficient of acceleration is given by 3.5×10^7 at 25° , when the units are, time in minutes, and weights in gram-equivalents. The velocity of the sulphate formation is expressed by the equation $-d[H_2O_2]/dt = (1.5 \times 10^3 + 3.5 \times 10^7[H^+])[MoO_3][Na_2S_2O_3]$. Since this reaction itself furnishes H^+ ions, the change becomes autocatalytic. The velocity of the reaction in the presence of acetic acid and sodium acetate, added to define the H^+ -ion concentration, is given by the expression: $-d[H_2O_2]/dt = dy/dt = \{1.5 \times 10^3 + 3.5 \times 10^7 k((CH_3 \cdot CO_2H) + y/4) / \alpha[(CH_3 \cdot CO_2Na) - y/4]\} \cdot [MoO_3][(Na_2S_2O_3) - y/8]$, in which the quantities in round brackets represent initial concentrations, α the degree of dissociation of the acetate, and k the dissociation constant of the acetic acid. This equation admits of values being calculated which are in close agreement with the experimentally determined values. When the conditions of the

reaction are so chosen that the formation of both sulphate and tetrathionate occur simultaneously, the hydrogen-ion concentration is affected by both, the former producing hydrogen ions, and the latter removing them. The effect of the tetrathionate formation is consequently to retard the autocatalytic action of the hydrogen ion, and this can proceed so far as to convert a positive autocatalysis into a negative autocatalysis. With respect to the mechanism of the reaction, it is suggested that the catalysis is brought about by an oxidation, and that a highly dissociated permolybdic acid is produced as an intermediate product.

J. F. S.

The Intervention of the Number π in the Relationships between Atomic Weights. P. DAMBIER (*J. Chim. phys.*, 1913, **11**, 260—266).—Two types of arithmetical relationship involving the number π exist between atomic weights. The first type, $R_1/R_2 = \pi/n$, where n is an integer, is exemplified in the ratio $3\text{I}/(\text{Cl} + \text{Br} + \text{I}) = 3.1417/2$, using Stas's atomic weights. The second type is $(M \pm n\pi)/(M' \pm n'\pi) = a/b$, where M and M' are molecular weights, and n, n', a, b simple integers. An example is $(\text{HCl} + 2\pi)/(\text{NH}_3 - 2\pi) = 4$, which leads to a value $\pi = 3.1416$ when the Geneva atomic weights are used instead of Stas's. It is urged that the intervention of π in these relationships is significant of some general connexion between the elements, but it must be assumed that atomic weights vary according as the atoms are neutral or ionised.

R. J. C.

The Intervention of the Number π in the Relationships between Atomic Weights. PHILIPPE A. GUYE (*J. Chim. phys.*, 1913, **11**, 267—268).—Such considerations as those put forward by Dambier (preceding abstract) and by Nicholson (*A.*, 1912, ii, 35) must certainly be taken account of in the study of atomic relationships.

R. J. C.

Theory of Electrical and Chemical Atomic Forces. ALFRED BYK (*Ber. Deut. physikal. Ges.*, 1913, **15**, 524—533).—A mathematical paper in which the author propounds a theory of the atom in which no structural hypotheses are contained. The applications of the theory to the physics and chemistry of the atom are indicated. The heat of dissociation of the chemical molecules and their cross section are calculated on the theory and compared with experimental results.

J. F. S.

Molecular Compounds as Primary Stages of Chemical Reactions. CARL ENGLER (*Eighth. Inter. Cong. App. Chem.*, 1912, **25**, 131—140).—Evidence is adduced in support of the view that in many chemical reactions the reacting molecules first unite to form molecular compounds. Attention is directed particularly to the question of oxidation, and the author's theory expressed in his papers on autoxidation is emphasised, namely, that oxidation generally takes place by direct attachment of a molecule of oxygen

leading to the formation of a peroxide. This theory is confirmed by a series of investigations carried out by the author and his co-workers on the oxidation of organic compounds, such as the fulvenes and ketens. The course of the reaction in the formation of peroxides can be represented by the three following stages:

(1) $M:O:O$ (asymmetrical), (2) $M \begin{smallmatrix} \diagup O \\ \diagdown O \end{smallmatrix}$ (symmetrical), and (3) $M \begin{smallmatrix} \diagup O \\ \diagdown O \end{smallmatrix}$.

The asymmetrical oxide passes spontaneously, as a rule, into the symmetrical form, which is but rarely transformed into the stable modification (3). Hydrogen peroxide and ozone are quoted as examples of the first form, and barium peroxide and lead peroxide as examples of the second and third respectively. The second (and first) form corresponds with Schönbein's "autozonides" and the third form with his "ozonides."

E. G.

Electron Conception of Valence. III. Oxygen Compounds.

JOHN M. NELSON and K. GEORGE FALK (*Eighth Inter. Cong. App. Chem.*, 1912, 6, 212—221. Compare A., 1911, ii, 104, 711).—The consideration of the direction of the valencies is extended to oxygen compounds. Owing to the pronounced electronegative character of oxygen, the problem is simpler than in the case of carbon, for in most cases the valencies can be assumed to be directed toward the oxygen atom, this having taken up two electrons, either from the same atom or two similar or different atoms. Tautomerism is due to the replacement of a hydrogen atom and the redistribution of the valencies of the other atoms, the oxygen atom always having two valencies directed towards it. The isomerism of the benzopinacolins should also be regarded as a case of tautomerism, the only difference being that a phenyl group migrates.

In the case of isomeric ketones, however, it is necessary to assume that the valencies in the carbonyl group are not both directed towards the oxygen atom. The symbol $C \rightleftharpoons O$ is assigned to the more stable form, and $C \rightleftharpoons O$ to the unstable.

The tautomeric forms of hydrogen peroxide are represented by the formulæ $H \rightarrow O \rightarrow O \leftarrow H$ and $\begin{smallmatrix} H \diagdown \\ H \diagup \end{smallmatrix} O \rightleftharpoons O$. The formulation of hydrates is exemplified with nickel chloride as type.

J. C. W.

The Conception of Valency as an Electronic Action.

K. GEORGE FALK and JOHN M. NELSON (*J. pr. Chem.*, 1913, [ii], 88, 97—128).—The views expressed in this paper have already been published (A., 1911, ii, 104, 711, and preceding abstract). F. B.

Reminiscences of R. W. Bunsen. WILLEM A. VAN DORP (*Chem. Weekblad*, 1913, 10, 600—603).—An account of the author's personal experiences as a student in the Heidelberg laboratories under Bunsen in 1869.

A. J. W.

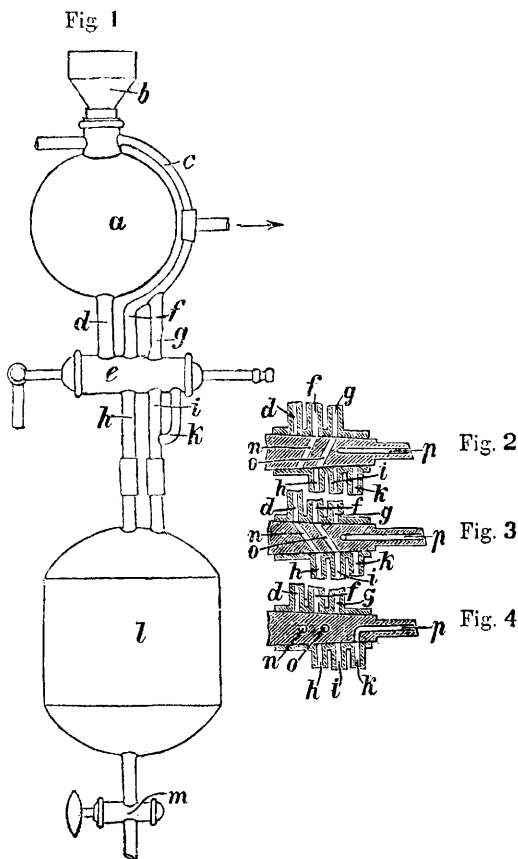
The Ring Figures in Frozen Gelatin. HUGO ROHONYI (*Biochem. Zeitsch.*, 1913, 52, 210—214).—If solutions of gelatin are poured into

a test-tube and then poured out again, and the thin layers of the solutions adhering to the glass are then frozen by the method described by the author, characteristic ring figures are formed, which are illustrated in the text. These are similar to Liesegang's figures obtained when silver nitrate is dropped into a film of potassium dichromate solution in gelatin. Ostwald's explanation of the Liesegang figures is quoted, and it is assumed that this also explains the phenomena with frozen gelatin recorded by the author.

S. B. S.

Combined Distillation Apparatus. LENHARD (*Zeitsch. angew. Chem.*, 1913, 26, 431).—A piece of apparatus is described which may be used for reflux and condensing operations. In the first case, the condenser is arranged vertically, and its lower end is attached to the flask by means of a short length of tube the ends of which form ground-in joints with the condenser tube and a tube sealed into the glass stopper of the flask; a tapped funnel is also sealed into the stopper. When required for distillation, the condenser is inclined and attached to the flask by means of a bent tube, the ends of which also form ground-in joints with the flask and condenser. W. P. S.

New Vacuum Filtering Apparatus for Continuous Filtration. WALTER DECKERT (*Zeitsch. anal. Chem.*, 1913, 52, 547—548).—The apparatus (see Fig. 1) consists of two reservoirs *a* and *l*, which are connected by means of a multiple-way stopcock *e*. On the reservoir *a* is placed the funnel *b*. The stopcock has three channels, of which two, *n* and *o*, run in an oblique direction parallel to each other (Figs. 2 and 3), whilst the third, *p*, terminates in an axial tube



giving communication with the outer air (Fig. 4). When the stopcock is placed in the position indicated in Fig. 2, the reservoir *l* is exhausted during the filtration in the passage *c g h l*; in the position in Fig. 3, the vacuum in reservoir *l* is obtained in the passage *c f i l*, whilst the filtrate runs through the passage *d h l* into the reservoir *l*. On placing the stopcock in the position indicated by Fig. 4, the outer air enters through the passage *p k l* into the lower reservoir, from which the liquid may then be run into a vessel by opening tap *m*. The bores in the stopcock are so arranged that in order to carry out the required manipulations, the stopcock has only to be turned like the hands of a clock; twice in succession 90° , once 180° .

The chief advantage of the apparatus is the withdrawal of filtrate without disturbing the filtering process. L. DE K.

Universal Extraction Apparatus. HAHN (*Chem. Zeit.*, 1913, **37**, 880).—A modified form of apparatus serving for the extraction of solid matters as well as for heavy or light liquids, and requiring but little solvent. L. DE K.

Lecture Experiment. An Apparatus for the Volumetric Synthesis of Water. MILAN J. STRITAR (*Chem. Zeit.*, 1913, **37**, 860).—The author describes a modified Hofmann apparatus for demonstrating the volumetric composition of water. It is claimed that the apparatus can be filled with mercury by one person without assistance, that it is easily obtained free from air, and that a comparatively small quantity of mercury (1.5 kilo.) is required to fill it. J. F. S.
