celium within the host. Six days after inoculation, only five out of a hundred appressoria had entered. Material taken eight, ten, and even twelve days after inoculation still showed numerous appressoria and a relatively limited number of infections. For greater accuracy, counts were made and the results tabulated as follows:

No. of Days after Inoculation	Total No. of Sporelings Counted	No. of Entries	Percentage of Entries
6	100	5	5
8	133	14	10 +
10	77	7	9
12	145	16	11 +

Under the conditions of this experiment, only about ten per cent. of the young rust fungi enter. The other ninety per cent. remain outside the stomata until they dry and fall off. By the twelfth day, under greenhouse conditions, practically all the appressoria are withered and collapsed.

Tangential sections of Kanred and Mindum leaves were examined. In these the stomatal slit was measured in length, in width at center and at its widest point, which is near the end, and averages taken. The same was done with Mindum, a durum variety somewhat resistant to this strain of rust. The stomatal aperture in Kanred is extremely long and narrow, while that of Mindum, a less resistant variety, is short, and very variable in width, the average width being about *twice* that of Kanred. In Mindum, the rust sporeling enters freely, while in Kanred nine tenths of them are excluded. It is possible that the naturally small stomatal opening of Kanred is still further narrowed by the action of the guard cells when an appressorium comes in contact with the stoma. A more comprehensive and fully illustrated account, including similar observations on other varieties of wheat, and reporting resistance phenomena which follow actual infection, is now in preparation.

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THE AMERICAN CHEMICAL SOCIETY

ROCHESTER MEETING

DIVISION OF PHYSICAL AND INORGANIC CHEMISTRY

H. N. Holmes, *chairman*
S. E. Sheppard, *secretary*

Symposium on Contact Catalysis

Platinum black and carbon monoxide. Esterification by silica gel: C. H. Milligan and E. Emmet Reid. A mixture of equivalent amounts of acetic acid and ethyl alcohol has been passed over silica gel at 150°, 250°, 350° C. It has been found that silica gel is a very active catalyst, more than twice as active as titania, the best catalyst previously known for this reaction. When the mixture is passed rather slowly at 150° the percentage of esterification is 75 to 80, which is much beyond 67 per cent., the accepted limit for this reaction.

Adsorption by oxide catalysts and the mechanism of oxidation processes: A. F. Benton.

Dissociation of some mixed oxides: J. C. Frazer.

The adsorption of gases by metallic catalysts: H. S. Taylor and R. M. Burns. The adsorptions of hydrogen, carbon monoxide, carbon dioxide and ethylene by finely divided nickel, cobalt, iron, copper, palladium and platinum has been found to be of a specific character quite different in nature from adsorption by porous inert adsorbents of the charcoal type. The extent of adsorption was shown to be a function of the mode of preparation and to be especially less pronounced the higher the temperature at which the metal was prepared. The analogy of this fact with the corresponding facts of catalytic behavior has been noted. Adsorption isotherms at 25° C. of hydrogen with nickel, and of carbon monoxide with copper have shown that adsorption increases rapidly with increasing partial pressures below 300 mm. and becomes practically independent of pressure above this pressure.

The action of nickel on diethyl ether: A study in contact catalysis. Preliminary report: Francis L. Simons. A report is given of preliminary work in the study of the catalytic decomposition of ether by nickel. The study was undertaken in the hope of throwing light on the mechanism of the action of nickel on alcohol and the simpler esters. The apparatus used is described in detail and the general procedure given. From the results so far, it appears that ether is decomposed into H_2, C_2H_4 and CH_3CHO, as Bancroft suggests. The composition of the gas evolved during the reaction is satisfactorily explained on this basis. The work is being continued.

R. p. m. as catalyst: C. H. MILLIGAN and E. EMMET REID. It has long been known that ethylene can be used in place of ethyl chloride in the preparation of ethyl benzene by the Friedel and Crafts reaction but the absorption rate is so slow under usual conditions that the method has not been attractive for preparing ethyl benzene. We find that the reaction can be made to go so rapidly by using a high speed stirrer that this becomes an efficient preparation method. A mixture of 250 g. benzene and 50 g. aluminum chloride absorbs as much as 1,800 c.c. of ethylene per minute when stirrer is run at 1,300 r. p. m.

Catalysis in the interaction of carbon with steam and carbon dioxide: H. A. NEVILLE and H. S. TAYLOR. The catalytic activity of alkali carbonates, alkaline earths and various salts in promoting reaction between steam and carbon has been shown to be paralleled by similar effects in the acceleration of interaction of carbon and carbon dioxide. In each case potassium carbonate has been found to be the most active salt catalyst. Reduced nickel promotes interaction of carbon and carbon dioxide markedly. In explanation of the mechanism of the two reaction processes it has been shown that adsorption of carbon dioxide by carbon at 445° C. is markedly increased by addition to the carbon of such accelerating agents, although these latter themselves show no adsorptive capacity for the gas.

Catalysis in the reduction of oxides and the catalytic combination of hydrogen and oxygen: R. N. PEASE and H. S. TAYLOR. Oxygen and water vapor, present in hydrogen used for reduction of copper oxide, markedly inhibit the action; addition of reduced copper to the oxide appears to accelerate the reaction. The induction period in the reaction is attributed (*a*) to initial drying of the oxide, (*b*) to slow initial formation of copper which then acts as a catalyst. It is doubtful whether the catalytic combustion of hydrogen and oxygen in presence of copper can be represented as an alternate oxidation and reduction process as it has been found that when hydrogen containing oxygen is passed over copper oxide at 150° C., no appreciable water is formed and, at lower temperatures, the activity is reduced as the catalyst becomes progressively oxidized. The formation of water in presence of copper may take place through interaction of hydrogen on an oxygen molecule which is in process of combining to form oxide, that is, at the instant of collision with the copper surface.

A case of autooxidation: $MnO_2 \rightarrow HMnO_4$: J. C. FRASER.

Oxidation and reduction by organic compounds: C. H. MILLIGAN and E. EMMET REID.

The action of alumina, titania, and thoria on ethyl and isopropyl acetate: HOMER ADKINS and A. C. KRAUSE.

The catalytic electrolytic oxidation of SO_2: COLIN G. FINK. The electrolytic oxidation of SO_2 with various anodes was investigated. It was found that graphite anodes will catalyze the oxidation providing ferrous-ferric ions are present in solution. In the absence of iron, no catalytic effect due to the graphite could be observed. On the other hand, an inert anode such as ferro-silicon, in the presence of ferrous-ferric ions will not catalyze the SO_2 oxidation. The combined effect of the graphite anode and the iron is essential to accelerate the reaction.

The decomposition of ethyl acetate induced by catalytic nickel: HOMER ADKINS and P. W. SIMMONDS.

The catalytic influence of foreign oxides on the decomposition of silver oxide, mercuric oxide and barium peroxide: JAMES KENDALL and FRANCIS J. FUCHE. The effect of foreign oxides on the temperature and rate of decomposition of silver oxide, mercuric oxide and barium peroxide under an oxygen pressure of one atmosphere has been experimentally investigated. In almost all of the systems examined, the added oxide induces a considerable change in the decomposition temperature. Most commonly there is a marked lowering in this point; thus (to cite an extreme case) an equimolecular mixture of BaO_2 and CuO has an oxygen equilibrium pressure of one atmosphere at 355°, approximately 500° below the decomposition temperature of pure BaO_2. In a few systems a comparatively small rise in the decomposition temperature is indicated. In all instances, however, the rate of oxygen evolution is significantly increased.

A new clock reaction: G. S. FORBES, H. W. ESTILL, and O. J. WALKER. The induction period, *t*, preceding precipitation of As_2S_3 from H_3AsO_3 or H_3AsO_4 in the presence of $H_2S_2O_3$, is extraordinarily sharp and reproducible. In the case of H_3AsO_3, $1/t = KC$ $Na_2S_2O_3$, but is independent of C H_3AsO_3, and also of C H provided $HC_2H_3O_2$ or very dilute HCl is used. The period increases greatly with C HCl. The rate of precipitation, also highly reproducible, is very great at first, diminishes very rapidly, but may not become zero before 3,000 hours at room temperature. With $HC_2H_3O_2$ the initial rate $= k'C$ H, but with moderate values of C HCl this proportion becomes inverse. Many other regularities, likewise affording clues to the reaction mechanism, have been noted.

The volumetric oxidation of sulfide to sulfate: H. H. WILLARD and W. E. CAKE. The alkaline sulfide solution obtained by absorbing H_2S in NaOH is oxidized quantitatively to sulfate if excess of standard hypobromite or hypochlorite is added, and sufficient hydroxide is present. The excess is then determined by adding KI, acidifying, then titrating the iodine with thiosulfate. The method may be applied also to freshly precipitated sulfides, such as ZnS. Since four times as much oxygen is required in this reaction as in the usual iodine titration, the method is especially suitable for small amounts of sulfur.

Making scientists: Recovering the normal curiosity in college students: EDWARD ELLERY. A normal boy and the investigating scientist have this in common—they are both living interrogation points. The investigator minus a "why" is an anomaly, and a boy without it is abnormal, if not defective. If college training knocks the natural "why" out of a boy, a reform can not too soon be instituted. Here is the way Union College is working to effect such a reform. At every opportunity work is required that takes the boy away from his textbook and laboratory manual and into the library for consultation of larger treatises and current periodicals. In the summer months, at the end of the junior year, a few of the best students receive appointments to the research laboratory of the General Electric Company, where they handle a piece of research work under the direct supervision of the leading members of the staff of that organization. In their last year in college, their time in the chemical laboratory is given to a continuation of this research work, or to a new problem. It is only the unconquerably dull boy that fails to react to this effort to awaken his natural "why."

The apparent irreversibility of the calomel electrode: A. W. LAUBENGAYER. When mercury is made anode in a chloride solution a high-resistance, black film forms over the surface of the mercury. This is composed of drops of mercury and particles of mercurous chloride. It is not known why mercurous chloride should be adsorbed so closely and mercurous sulphate not.

The theory of hydrogen overvoltage: D. A. MACINNES and W. R. HAINSWORTH. Experiments on the effect of pressure on hydrogen overvoltage show that the variation produced is in the direction predicted by the theory advanced by MacInnes and Alden; *i.e.*, the overvoltage increases when the pressure is decreased. On the other hand, computation of the overvoltage from the size of evolved bubbles fails for layer potentials, since the phenomena at metal surfaces get farther and farther away from equilibrium conditions as higher overvoltages are reached. However, the fundamental assumption that overvoltage is an extreme case of concentration polarization, retains its usefulness in explaining the experimental results, at least for the lower potentials.

The hydrogen electrode under high pressures: W. R. HAINSWORTH. The variation of the E. M. F. of the cell, $H_2 1HCl$ (C.1nHCl), HgCl/Hg, with pressure has been measured from one to 400 atmospheres. It was found that thermodynamic calculations involving (1) the deviation of hydrogen from a perfect gas, (2) the partial molal volume of HCl in 0.1 NHCl, (3) the molal volumes of mercury and calomel, and (4) the change of HCl concentration with the compressibility of the solution, served to reproduce the observed potential of the cell within 0.2 mv. throughout the pressure range studied. This leads to the conclusions, (*a*) that the "thermodynamic environment" is not appreciably changed by the molecular hydrogen in solution, or by compression, and (*b*) that the fugacity (or effective pressure) of hydrogen can be calculated up to 400 atmospheres from the equation of state developed by Keyes.

Potassium ammonoaluminate and ammonomanganite: FRANCIS W. BERGSTROM. The author has added an ammonoaluminate and an ammonomanganite of potassium to Franklin's list of salts formed by the action of potassium amide, in liquid ammonia solution, on the amides, imides or nitrides of other metals. The aluminate has been prepared by the action of a solution of potassium amide on amalgamated metallic aluminium. Its composition is represented by the formula $Al(NHK)(NH_2)_2$. Potassium ammonomanganite has been obtained in the form of rose colored crystals by the action of an excess of potassium amide on manganese thiocyanate in accordance with the reaction represented by the equation

$$Mn(SCN)_2 + 4KNH_2 = Mn(NHK)_2.2NH_3 + 2KSCN.$$

A quantitative study of adsorption in solution and at interfaces of sugars, dextrin, starch, gum arabic and egg albumen, and the mechanism of their action as emulsifying agents: GEORGE L. CLARK and WM. A. MANN. By the most accurate method known—the use of the stalagmometer for measurement of interfacial tension and the Morgan drop weight apparatus for measurement of surface tension of single liquids—the adsorption of sugar in solution has been determined to be negative, the adsorption increasing in ratio with increase in concentration of sugar, while the adsorption of sugar at the interface is positive and increases in the same ratio as in solution. Dextrin and starch, in very dilute solutions, are negatively adsorbed in solution but, in more concentrated solutions, are positively adsorbed while at the interface they are negatively adsorbed—starch more so than dextrin. Gum arabic behaves, in this respect, in the same manner as starch. A favorable surface tension, seemingly, is not a prerequisite for a good emulsion with any solution studied, although viscosity is an important factor. Better emulsions have been obtained with egg albumen—saturated solutions—than with any other solution under inspection.

The preparation, properties and molecular volume relationships of the ammines and hydrates of cobaltous fluoride, bromide, nitrate, carbonate and citrate: GEORGE L. CLARK and H. K. BUCKNER. The molecular volume compression of the subsidiary valence groups, NH_3 and H_2O, were studied in the same manner as in the previous work on the chloride and sulphate of cobalt (*J. Am. Chem. Soc.*, 42, 2483 (1920)) in light of difference in volumes between anion and cation and possibilities of space cavities. It was confirmed that the larger the difference between anion and cation the greater the possibility of cavities, and the less the compression of NH_3 and H_2O required the more stable the compound and the greater the possibility of holding a maximum number of groups. The various compounds prepared and studied are distinctly new with the exception of cobaltous bromide hexammine and cobaltous nitrate hexammine, the following being representative: cobaltous fluoride hexammine, cobaltous nitrate di-hydrate, ammines of cobaltous nitrate indicating more than six subsidiary valence groups and ammines of cobaltous carbonate and citrate.

Emulsification with soaps of linoleic and ricinoleic acids: GEORGE L. CLARK and H. K. BUCKNER. This work has involved the quantitative study by means of surface energy measurements for solutions and at the interface between aqueous solution and a pure oil by the drop weight method of the following points: the solubility in water of the free acids from the log. concentration-surface tension curve; the adsorption at the surface and the volume occupied by each molecule in the surface; the surface tensions of various concentrations of the soaps in solution, the effect upon the interfacial tension between water and pure toluene, the effect of the hydrolysis of the soap and the prevention of hydrolysis by the addition of various concentrations of NaOH to a given concentration of the soap; a test of the antagonistic effect of sodium and calcium soaps by testing the effect upon the interfacial tension between water and toluene containing a small amount of the free acid of adding various salts of sodium and calcium, resulting in the fact that the sodium salt promotes emulsions of oil in water and calcium salts promote emulsions of water in oil; and finally a thorough comparison of all the data so obtained with previous work on soaps of palmitic, stearic and oleic acids. All results of this purely quantitative study are necessarily numerical and can not be included in a short abstract.

Notes on the preparation of pure platinum: EDWARD WICHERS. The paper briefly states the method used in preparing platinum sponge free from other platinum metals and base metals, and describes in more detail the work that has thus far been done on the conversion of this sponge to compact metal with minimum contamination. E.M.F. tests show the resulting platinum to be of higher purity than the best previously obtainable, *i.e.*, the thermoelement wire of Heraeus, and show the difference in purity to be a matter of calcium content. Results of experiments with magnesia refractories are also given. There is a brief outline of further work to be done on this subject.

Modified method for the determination of iron and vanadium after reduction by hydrogen sulphide: G. E. F. LUNDELL and H. B. KNOWLES. Published methods for the determination of iron and vanadium after reduction by hydrogen sulphide ordinarily yield high values. A modified method which is sufficiently accurate for most purposes is presented, and a procedure for accurate analysis is outlined.

The free energy of dilution of hydrobromic acid; the activities of its ions in very dilute and con-

centrated solutions: MILLER SPENCER and ALBERT G. LOOMIS.

The ultra-violet arc spectrum of yttrium: L. F. YNTEMA and B. S. HOPKINS. The ultra-violet arc spectrum of Y was measured, using the yttrium oxide prepared by one of us for the determination of the atomic weight value accepted by the International Committee. The spectrograph used is an autocollimating quartz prism machine manufactured by Adam Hilger, of London. A current of 4 amperes at an E.M.F. of 220 volts was passed between vertical copper electrodes, the lower of which held the Y_2O_3 in its crater. Several prominent lines, attributed to Y in the literature, were absent, and several new lines were measured. The results given are the mean of five determinations.

On the viscosity of gelatin sols: ROBERT HERMAN BOGUE. Experiments were carried out upon gelatin sols to accurately determine the relation between viscosity and concentration. The data have been applied to Hatschek's formula for the viscosity of emulsoids and the value A^1/A, representing the volume occupied per unit weight of dispersed phase, was shown not to be constant with varying concentration, but to rise to a maximum and thereafter regularly decline. A tentative explanation is presented based upon the effect which increasing concentrations of dispersed phase will have upon the surface tension of the dispersion medium. An empirical expression defining the departure of the values obtained under varying conditions for Hatschek's constant is given.

The structure of molecules of water: IRVING LANGMUIR. Dennison has recently shown by X-ray crystal analysis that ice consists of molecules of the formula H_4O_2. In view of our knowledge of the structure of atoms it is not possible to account for the existence of this molecule on the basis of quadrivalent oxygen atoms. If pairs of electrons (duplets) constitute the valence bond, there can be no such bond between the two oxygen atoms. A structure for this molecule is therefore proposed in which the four hydrogen nuclei bind the two oxygen atoms. The duplet held by each hydrogen nucleus has one of its electrons in each of the oxygen octets, instead of the more usual arrangement in which both electrons of a duplet form part of the same octet.

The purification of helium by means of charcoal: L. FINKELSTEIN.

The importance of diffusion in organic electrochemistry: ROBERT E. WILSON and MERRILL A. YOUTZ. The authors, in searching for definite evidence of depolarization in the electrolytic halogenation of organic compounds, found that either slow reaction rate or slow diffusion, or both, prevented any marked depolarization. Experiments on the oxidation of $FeCl_2$ in HCl gave surprisingly accurate information as to the rate of diffusion under a variety of conditions, and showed that without stirring there is a film of stationary liquid about 0.5 mm. thick through which diffusion must take place. This emphasizes the great importance of violent stirring and of the use of rapidly diffusing inorganic carriers to extend the sphere of the organic reaction from a surface to a volume.

Observations on the drying and swelling of gelatine gels: S. E. SHEPPARD and F. A. ELLIOTT. Attention is drawn to the importance of capillarity in the first phase of drying of jellies. It is shown that this, in conjunction with factors depending upon the shape of the jelly, causes the formation of an exo-skeleton tending to conserve or increase the original external surface extension. It is chiefly due to this, rather than to any internal supermolecular structure, that dried jellies on reswelling in water tend to return to their original concentration.

Note on the influence of silver salts in catalyzing the decomposition of ammonium persulphate solutions: S. E. SHEPPARD and A. BALLARD. The influence of silver salts in facilitating the decomposition of ammonium persulphate in solution, first observed by H. Marshall and J. Inglis, has been confirmed, and quantitative data on the rate of change in relation to the silver content obtained.

Further developments of the hydrogen electrode: FELIX A. ELLIOTT. Two new forms of hydrogen electrode were described representing probably the limits of simplicity and ruggedness without reducing accuracy and rapidity of operation. Especial attention has been given in designing this new apparatus to reduce the internal resistance to the lowest possible value so that a less sensitive and hence cheaper, simpler and portable electrical measuring instrument might be used. Such an instrument was described, working on the potentiometer principle and employing a pivot type movement. Examples of results obtained with the two types of apparatus indicate that potentials are reproducible to about 0.1 mv.

Note on silver soap gels: G. STAFFORD WHITBY. It has been observed that the silver salts of the fatty acids are capable of giving reversible gels in a variety of organic liquids—particularly in the homologs of benzene and in halogenated derivatives of benzene and its homologs. The silver salts form gels at a lower point in the series of saturated fatty acids than do the alkali-metal salts; gels being obtained with silver caproate. A number of regularities were discernible. The silver salts of the higher members of the saturated fatty acid series show a greater solvation capacity than those of the lower ones. None of the saturated fatty acid silver salts gave a gel in benzene; but silver oleate did. Speaking generally, in the case of solvents of the same general chemical character, the higher the boiling point of the solvent, the greater appeared to be the solvation capacity of a given salt, and the smaller the extent to which the gel from a given salt suffered syneresis.

Catalytic effect in the reaction between ketones and halogens in aqueous solutions: F. O. RICE. The velocity constant of the reaction between acetone and bromine is independent of the bromine concentration and Lapworth (*J. C. S. Trans.*, 1904, p. 30) explained this by saying that the acetone slowly enolized and the addition of bromine and splitting off of hydrobromic acid were practically instantaneous. This is probably incorrect since higher ketones have the same velocity constant as acetone, and an explanation based on the radiation theory was offered. The reaction is accelerated by neutral salts contrary to Lapworth's statement.

The transference numbers of sulfuric acid by the concentration cell method: A. L. FERGUSON and W. G. FRANCE. A cell combination was used which permitted the measurement of all the required potentials from one set-up. The value obtained for the transference number for the anion in concentrations between $M/10$ and $M/100$ at 25° C. was .1868 ± .0007. The method was shown to be highly reliable. In all of the calculations it was assumed that sulfuric acid dissociates into two hydrogen and one sulfate ion. This assumption was substantiated by the results obtained. A formula for boundary potential was developed in which boundary potential may be obtained from potential measurements alone.

The influence of gelatin on the transference numbers of sulfuric acid: ALFRED L. FERGUSON and W. G. FRANCE. The transference numbers were determined by the concentration cell method. Solutions of sulfuric acid containing from 0.5 per cent. to 20 per cent. gelatin were used. The transference numbers of the anion increased from .187 for pure acid to .685 for acid containing 20 per cent. gelatin. In the 20 per cent. gelatin solution the boundary potential of both concentration cells became zero. The decrease in conductivity was approximately proportional to the gelatin added. The results are probably best explained on the assumption that there is a chemical action between the gelatin and sulfuric acid in which a single compound is formed. In this compound the hydrogen of the acid loses its identity and when the compound dissociates there is formed a complex gelatin hydrogen positive ion and a negative sulfate ion.

The entropy of monatomic gases: GILBERT N. LEWIS.

The electrometric titration of uranium with potassium dichromate and potassium permanganate: D. T. EWING and E. F. ELDRIDGE.

The heat of coagulation of ferric oxide hydrosol by electrolytes: FREDERICK L. BROWN and J. H. MATHEWS.

Some quantitative experiments on coagulation of colloids: RAY V. MURPHY and J. H. MATHEWS. The lowest concentration (limiting concentration) of electrolytes necessary to coagulate hydrous ferric oxide sol has been studied as a function of the purity of the sol (ratio of gram-equivalents of Fe to gram-equivalents of Cl) and of the concentration of Fe_2O_3. Chloride, chromate and ferricyanide ions were used in the form of the potassium salts. The conclusions drawn are: (1) The limiting concentration decreases with increasing purity in the case of all three ions, the mechanism of the process being evidently similar for the three ions; (2) The limiting concentration decreases markedly with decreasing concentration of the sol in the case of all three ions, but the relation indicated by Burton and Bishop, *Jour. Phys. Chem.*, 24, 701 (1920), for mastic, As_2S_3 and Cu sols, holds for Fe_2O_3 hydrosol only in the case of the trivalent ion.

The alkalinity of Searles Lake brine: ROGER C. WELLS. The title may mean either the titration alkalinity or the hydrogen ion concentrations. The latter may be considered as determined by certain proportions of the four buffer substances Na_2CO_3, $NaHCO_3$, $Na_2B_4O_7$, and $Na_2B_2O_4$. The writer has found for the brine $P_H = 9.48$. By determining the P_H values of artificial brines containing each pair of buffers separately it is possible to draw curves from which by interpolation the proper proportions of the buffers to yield $P_H = 9.48$ may be read. This method serves as a check of the analytical determinations and yields a logical conventional form for expressing the whole analysis of the brine.

The vapor density of technical phosgene: A. F. O. Germann and Vernon Jersey. A 75 gm. sample of technical phosgene was distilled from a large cylinder of the liquefied gas, obtained from the Chemical Warfare Service through Dr. Goss. Pure phosgene has a vapor tension at 0° C. of about 552 mm.; the sample taken showed a vapor tension in excess of one atmosphere at — 80° C., that is, in a bath of solid carbon dioxide and acetone. The sample was subjected to fractional distillation in a vacuum until the vapor tension at 0° C. was approximately correct. Following this, three fractional distillations alternated with three determinations of the vapor density of the gas, until five groups of three determinations each had been obtained for the vapor density, and the nearly pure gas had been fractionally distilled 15 times.

Average of 1st group of densities.....4.4708
" " 2d " " " 4.5060
" " 3d " " " 4.5216
" " 4th " " " 4.5244
" " 5th " " " 4.5263

The values given are in grams per liter at standard conditions, uncorrected for the compressibility of the gas and for the contraction of the globes when evacuated. Technical phosgene is very impure. The principal impurities are very volatile and of relatively low molecular weight, probably carbon dioxide and hydrogen chloride resulting from hydrolysis. Repeated fractional distillation yields a product whose density tends toward a maximum value, probably the value for pure phosgene.

The cryoscopy of boron trifluoride solutions: V. Systems with methyl ether and with methyl chloride: A. F. O. Germann and Marion Cleaveland. Gasselin prepared the compound $BF_3.(CH_3)_2O$ by mixing the gases; he obtained a liquid boiling at 126° C. This compound has been prepared from liquid boron trifluoride and liquid methyl ether in the course of the determination of the melting point curve of solutions of the two substances. The curve shows a eutectic at 3 per cent. BF_3 (molecular percentages) and a maximum at 50 per cent. The vapor tensions of solutions containing from 60 per cent. to 90 per cent. BF_3 were so high, that the form of apparatus used was inadequate. The form of the curve so far as determined seems to indicate the existence of a second compound in this interval. Methyl chloride was prepared from salt, sulfuric acid and wood alcohol; was purified by repeated fractional distillations; and gave the usual indications of a pure substance, such as constant freezing point for the first and last fractions of the liquid. The melting point curve with BF_3 shows two maxima, at 15 per cent. BF_3, and at 33 per cent. BF_3, and an angular point in the curve at 50 per cent. The form of the maxima at 15 per cent. is identical with that at 50 per cent. for methyl ether; the mixture yields about 15 per cent. of the total volume of a liquid, whose freezing and boiling points are identical with those of $BF_3.(CH_3)_2O$. The logical inference is that methyl chloride as prepared contains methyl ether as an impurity, and that this impurity yields a constant boiling mixture. It would seem that boron trifluoride might be used as a test for the presence of methyl ether in methyl chloride; the same test might be extended to the homologues. The interpretation of the other maxima mentioned must await the completion of further work on the purity of methyl chloride.

The cryoscopy of phosgene solutions: I. System with chlorine: A. F. O. Germann and V. Jersey. The melting point curve of solutions of phosgene and chlorine was determined. The curve is very complex. There is a eutectic at 25 per cent. (molecular percentages) chlorine; and angular points in the curve at 6 per cent., 11 per cent., 50 per cent., 63 per cent., 75 per cent. and 91 per cent. chlorine. The following compounds, which dissociate at the melting point, are indicated: $16COCl_2.Cl_2$; $8COCl_2.Cl_2$; $COCl_2.Cl_2$; $3COCl_2.5Cl_2$; $COCl_2.3Cl_2$; and $COCl_2.10Cl_2$. The second of these, chlorine octaphosgenate, is particularly interesting, as corresponding with the octahydrate of chlorine. The affinity of chlorine for phosgene, and the instability of the compounds would seem to offer an explanation of the mechanism of certain phases of the catalysis of carbon monoxide and chlorine by means of charcoal saturated with chlorine. If we assume a layer of chlorine molecules on the surface of the charcoal, the high concentration of chlorine thus obtained might be supposed in the presence of carbon monoxide to shift the equilibrium in the direction of one of the chlorine-phosgene complexes, which promptly decomposes because of its instability, leaving the surface film of chlorine for further action. It would be desirable to determine the melting point curve of carbon monoxide and chlorine solutions, to clear up some of the points involved in this reaction.

Charles L. Parsons,
Secretary