very clearly are not indigenous to the flood plain materials that form the ridge. The supposition is that they were forced up from below by gaseous and water pressure that gave rise to the craterlets.

Age: No evidences as to age was obtained by the writer. However, as similar craters are found farther to the north and are there shown to have been formed at the time of the New Madrid earthquake, it is logical to assume that these were formed during the same disturbances.

E. T. THOMAS
UNIVERSITY OF ARKANSAS

AZOTOBACTER IN SOILS[1]

SOME time ago the writer[2] called attention to the apparent relation existing between the presence of Azotobacter in soils and the absolute reaction of the soil. At that time less than one hundred soils, all local, had been examined and the reaction was determined colorimetrically upon an extract of the soil. Since then 418 samples of soil collected from 39 counties in Kansas and 25 states other than Kansas have been cultured for Azotobacter and their presence or absence in such cultures compared with the absolute reaction of the soil determined colorimetrically upon an extract of the soil, and also with the reaction of the soil determined electrometrically upon a suspension of the soil.

These soils have been arbitrarily divided into two groups: those, the hydrogen-ion concentration of which was found to be greater than 1×10^{-6}; and those with a lower hydrogen-ion concentration. This particular division point has been chosen because the large amount of data that have been accumulated indicate that the maximum hydrogen-ion concentration tolerated by Azotobacter is very near this point. Comparing the presence and absence of Azotobacter in these two soil groups with the reaction we can, by making use of Yule's[3] association correlation formula, obtain a mathematical expression for the association or correlation existing between the reaction and the presence or absence of Azotobacter.

An application of this formula to our data gives, when the reaction of the soil was determined colorimetrically, a coefficient of 0.956. When the reaction was determined electrometrically the coefficient was found to be 0.942.

It has been demonstrated in this laboratory that when Azotobacter are introduced into a soil with a hydrogen-ion concentration greater than 1×10^{-6}, and not containing Azotobacter, they can exist therein for an appreciable length of time. Considering the relative ease with which soils may become inoculated under natural conditions, and also the probability that other conditions may inhibit the growth of Azotobacter in soils the reaction of which is favorable, it is believed that an association, or correlation coefficient as high as that indicated above is significant in indicating the influence of the hydrogen-ion concentration of a soil upon the ability of that soil to support Azotobacter.

P. L. GAINEY
KANSAS AGRICULTURAL
EXPERIMENT STATION

GENERAL MEETING OF THE AMERICAN CHEMICAL SOCIETY

THE sixty-third general meeting of the American Chemical Society was held at Birmingham, Alabama, Monday, April 3, to Friday, April 7, 1922, inclusive. The council meeting was held on the third, the general meeting on the morning and afternoon of the fourth and divisional meetings all day Wednesday and Thursday. Excursions were enjoyed in Birmingham on Friday, and some fifty of the members took a special excursion to Muscle Shoals on Saturday. Full details of the meeting and program will be found in the May, 1922, issue of the *Journal of Industrial and Engineering Chemistry*. The registration was 381, coming from 36 states and one from the island of Mauritius. Twenty-eight ladies attended the meeting.

General public addresses were given by Carlile P. Winslow, director, U. S. Forest Products Laboratory, on "The development of

---

[1] Contribution No. 47, Department of Bacteriology, Kansas Agricultural Experiment Station.

[2] P. L. Gainey: SCIENCE, N. S., 48, pp. 139-140; *Jour. Ag. Res.*, 14, pp. 265-271.

[3] G. Udny Yule, *Phil. Trans. Roy. Soc.*, Ser. A, Vol. 194, pp. 257-319.

the forest products industry in the south," and by William H. Stone, associate editor of the *Manufacturers' Record,* on "The remarkable development of the south and its relations to the American chemical industry," and a public address to the people of Birmingham by Professor Marston Taylor Bogert on the evening of April 5 under the title, "The flower fields and the organic chemist. Perfumes—natural and synthetic."

At the general business meeting held on Tuesday morning, April 4, resolutions and tributes were presented to the general society on our late honorary member, Giacomo Ciamician, and a long time councilor and active member, the late Dr. Charles Baskerville, the society remaining standing for a few moments as a tribute to the memory of each.

Following these tributes to members of the society, Dr. W. A. Noyes referred to the work of Adolph von Baeyer and Emil Fischer.

At the general meeting on Tuesday afternoon the following general papers were presented:

The manufacture of phosphoric acid in the electric furnace by the condensation and electrical precipitation method: THEODORE SWANN.

The pioneer's field in petroleum research: VAN H. MANNING.

Information needs in science and technology: CHARLES L. REESE.

Recent developments of the chemistry of rubber: W. C. GEER.

Some research problems in the canning industry: W. D. BIGELOW.

Chemistry in the old south and the new: FRANCIS P. VENABLE.

The following divisions and sections met: Divisions of Agricultural and Food Chemistry, Biological Chemistry, Dye Chemistry, Industrial and Engineering Chemistry, Organic Chemistry, Physical and Inorganic Chemistry, Rubber Chemistry, Sugar Chemistry, and Water, Sewage and Sanitation Chemistry; sections of Cellulose Chemistry, Chemical Education, History of Chemistry, and Petroleum Chemistry. Full details of their meetings will be found in the May issue of the *Journal of Industrial and Engineering Chemistry.*

On Tuesday evening a very enjoyable smoker was tendered by the Alabama Technical Association to the society at the Southern Club. The Country Club, the Roebuck Country Club and the Southern Club were open to the members throughout the meeting. On Friday excursions were made to the industrial plants around Birmingham and a barbecue was given at noon, which was a unique experience to many of the members and was enjoyed by all. The scientific program was extensive, 237 papers being presented.

DIVISION OF AGRICULTURAL AND FOOD CHEMISTRY

T. J. Bryan, *chairman*
C. S. Brinton, *secretary*

Composition, grade and baking qualities of self-rising flour: BENJAMIN R. JACOBS. The author discusses briefly grades of wheat and flour, and the process of milling ordinary flour. Examination of forty-seven samples of commercial self-rising flour and a few samples of this product made in the laboratory was made. The data give determinations of moisture, protein, total ash, added salt, P_2O_5, SO_3, CO_2 available and residual, microscopic count of bran and hair particles and baking tests. From these data the author shows that approximately 25 per cent. of the commercial product is of a grade inferior to what is commonly known as "straight" grade of flour. He also shows that a large number of samples contain excessive amounts of acid-calcium-phosphate and are deficient in CO_2. The baking experiments which are accompanied by photographs show that many of these self-rising flours make biscuits of inferior quality, this inferiority being due to the grade of flour used as well as to deficiencies in CO_2.

Bleached and self-rising flours: JUANITA E. DARRAH. This paper discusses the nutritive values of bleached and self-rising flours and gives the results of a series of experiments in feeding rats. The author's conclusions are that bleached flour is inferior. Self-rising flour is not necessarily inferior, if not bleached and if milled and compounded correctly and marketed in original packages. She recommends that stringent measures should be adopted to standardize such flours, and for protection of the honest miller there should be required a statement of the proportion of all ingredients on the label. It is concluded that the better growth of rats fed on products made from self-rising flour over those fed on bleached flour diet must be due to the presence of the phosphates in the leavening agents added in the manufacture of self-rising flour. This has led to a comparison of the phosphate and tartarate baking powders in addition to the flour problem. This work is still under way.

Composition and nutritive value of yeast grown in vitamine-free media: JUANITA E. DARRAH. The problem here was to determine the nutritive value of yeast grown from such substances as extracts of wheat and alfalfa, after a series of treatments to destroy the vitamine content. The media of B. MacDonald and McCollum was adopted for the experiments, but with a higher concentration of sugar. In addition, oats with vitamine destroyed were added. Rats and guinea pigs were given various diets, and the results were recorded. The author's conclusions are: 1. Yeast may be readily grown in vitamine-free media through an exceedingly large number of transfers. 2. Yeast grown in this way contains protein and nitrogenous bases of undoubted nutritive value. 3. Evidence of dietetic value of yeast grown in such media is not substantiated. There was only very slight indication of presence of water-soluble B, and none of fat-soluble A or water-soluble C.

New sources of water-soluble C and fat-soluble A in the southeast: JUANITA E. DARRAH. New sources of these vitamines have been found; water-soluble B and C are abundant in Jerusalem artichokes, and fat soluble A is fairly abundant in Avocado pears. Five guinea pigs were fed scurvy diet and succumbed in three weeks in so far as to show unmistakable symptoms of scurvy. Two of these died. One had just been through a previous attack of scurvy and had recovered. Another died, due to chilling on a cold day, when there was a delay in securing the artichokes. The other three recovered entirely on addition of the Jerusalem artichokes in five gram quantities per diem, added to the usual scurvy ration. When protein and mineral salts are supplied in suitable amounts, there is sufficient water-soluble B in Jerusalem artichokes to promote normal growth in white rats, when fed as the sole source of this vitamine in quantities of three grams dried artichoke to ten of the dry water-soluble B free mixed diet. There is sufficient fat-soluble A in Avocadoes to promote considerable growth in white rats; and to prevent sore eyes for a very long period, no xerophthalmia was induced. This is true of a diet adequate in other respects in protein, vitamine content and energy value. No reproduction tests have been secured.

Foods, facts, fancies and follies: EDWARD GUDEMAN. This paper discusses the subject of foods from the viewpoint of, firstly, their production, distribution, inclusive of adulteration and substitution, and secondly, from the viewpoint of national habits and follies as to consumption and conservation. It calls attention to the exhausting and wastage of good agricultural lands, the same as with other natural resources, and recommends the reclamation and occupation of the 2,225,000,000 acres of tillable land now lying barren, by employment of the unemployed, the same suggestion as made by President Roosevelt and Secretary Lane for returned soldiers in 1919, such work to be under direct control and supervision of the federal government. Such action would provide labor for thousands of men, would greatly increase the resources of the nation and would create a demand for the products of the government's nitrogen fixation plants, without coming into competition with existing fertilizer manufacturers. It is a paper for the layman without the use of scientific or technical terms.

The determination of hydrogen sulfide by foods when cooked at various temperatures: EDWARD F. KOHMAN. A method has been developed in which the food is heated in a flask in an autoclave. The flask is fitted with a stopper carrying two glass tubes. The inlet tube passes to the bottom of the flask and opens in the autoclave. The outlet tube passes through the pine wood stopper of the flask and up through the top of the autoclave and carries a glass stopcock. The autoclave is supplied with steam from a boiler. By this device food may be heated at any temperature for any length of time, while the water content remains constant. At the same time the hydrogen sulfide formed can be collected and determined as barium sulfate. The method is a quantitatively accurate one. Its application to other steam distillations under pressure is considered. It should have wide application in many organic preparations.

Studies of the availability of organic nitrogenous compounds. II (by title): C. S. ROBINSON.

The interpretation of mechanical analysis of soils as affected by soil colloids: R. O. E. DAVIS. So-called mechanical analysis of soils is one in which the soil is divided into its mineral constituents according to the grain sizes of the material. This mechanical analysis has an important bearing on indicating the character of the soil and its physical properties. From the results of such an analysis may be judged the water-holding capacity of soils and their relations to tillage operations, and, more important, their probable productivity. In carrying out such an analysis it becomes absolutely necessary, first, to break up all aggregates of soil material and then to go through the operations by which the different sizes are separated. The various methods employed have used various means for deflocculation of the soil material, but the method adopted as most satisfactory by the Bureau of Soils has been that of shaking the sample of soil with water for a period of about seven hours. Experiments recently carried on have demonstrated that the colloid content of soils is considerably greater than has been generally believed. These experiments have shown that the so-called clay separate obtained in the mechanical analysis, consisting of material grains smaller than .005 of a millimeter in diameter, is made up partly of aggregates of colloidal material. These aggregates have withstood the shaking operations without breaking down, but it has been demonstrated that they can be broken down and obtained in a dispersed state by rubbing lightly with the finger or rubber pestle. These results indicate the insufficiency of our present methods of mechanical analysis and show that in addition to the separations as obtained at present this method may have to be supplemented by a determination of the amount of colloid contained in the soil and the main separate groups, such as the clay and silt.

Studies on flavors, beverages and related products. 1. The determination of methyl anthranilate:[1] J. W. SALE and JOHN B. WILSON. A colorimetric method for the determination of methyl anthranilate in genuine and imitation grape products which depends upon the formation of a red azo dye, is described. The reagent used is sodium-1-naphthol-2-sulphonate. Experimental data are given which show that the method is quantitative. Advantages of the method described over others in current use are: first, the method is quantitative; second, the test is applied directly to distillate, thus avoiding possible loss of ester through extraction and subsequent evaporation of solvent; third, use of hydrazine sulphate in place of urea for destroying excess of nitrous acid. The method is recommended in the examination of products which are believed to be sophisticated.

Studies on flavors, beverages and related products. 2. Determination of methyl alcohol in extracts:[2] JOHN B. WILSON and J. W. SALE. The merits of a number of well-known tests for methyl alcohol are discussed and data are given which show their relative value and delicacy. The Denigée and Lyons' tests are found to be the most satisfactory for examination of flavoring extracts suspected of containing methyl alcohol. Flavoring extracts contain a variety of esters and essential oils which interfere unless the analysis is conducted properly. The sample to be analyzed should be adjusted so that it will have a volume of 100 cc and contain not more than ten per cent. of ethyl alcohol. Interfering substances are eliminated by salting the sample, extracting it with petroleum ether previous to distillation, and distilling, using a fractionating column. Thirty cc of distillate are collected in which will be found practically all the ethyl and methyl alcohols. The colorimetric tests to be applied are described in detail.

Relations between the active acidity and the lime-requirement of soils: EDGAR T. WHERRY. Lime requirement is stated in parts per thousand of CaO, and, because of the ease with which relative values can be appreciated, active soil acidity is stated in the form of specific acidity. The ratio between these in a given soil may be expressed by a correlation coefficient C, obtained by the equation: $L.R. = C \times (S.A. - 1)$. The value of C is believed to be a measure of the adsorptive power of the soil colloids for hydrogen-ion. The coefficient C has been found to vary so widely from one soil to another, from an untreated to a limed soil, and even from one depth to another in the same soil, that it is impracticable to calculate lime-requirement from acidity determinations in general, as has been proposed. Soils may be roughly classified on the basis of the value of C, a convenient ratio between classes being 3/10; but only if some simple procedure is first devised for classifying a given soil can there be obtained from its specific acidity a value for its lime-requirement.

Characteristic proteins in high and low protein corn: M. F. SHOWALTER and R. H. CARR. The protein content of corn is subject to wide variations by breeding and selection. The highest protein ear the writers have been able to produce contained 18.43 and the lowest 7.62 per cent. protein. A study has been made of the relative abundance of the different proteins in corn, and it was found that zein was the important protein which varied most, averaging 50.28 per cent. in high protein and only 31.85 per cent. in low protein corn. The averages for the other proteins are: glutelin 38.11, glolulin 3.70, albumen 3.92,

---

[1] Contribution from Water and Beverage Laboratory, Bureau of Chemistry.

[2] Contribution from Water and Beverage Laboratory, Bureau of Chemistry.

and amide 2.81 per cent. in the high protein and 52.15, 1.53, 8.21 and 6.25 respectively in the low protein corn. The zein is higher yet in high protein popcorn, averaging 57.24 per cent.

Errors in the determination of fat in cream: E. G. MAHIN and R. H. CARR. The use of hydrocarbon oils, non-miscible with butter fat, for eliminating the upper meniscus in the necks of Babcock bottles has become quite natural. More recent experimental results in the Purdue laboratory have shown that in the hands of the ordinary dairy tester this results in readings averaging about 0.5 per cent. lower than when the bottom of the meniscus, obtained without added oil, is used. As the latter has formerly been shown to be about 0.5 per cent. lower than is given by the gravimetric method, the use of such oils (such as "glymol") ordinarily results in a loss of about 1.0 per cent. of fat for each test. Ten large creameries in Indiana averaged 100,000 cream tests in 1917. Upon the assumption that each test represented a five-gallon lot, this represented approximately 500,000 gallons of cream. An experimental error of 1.0 per cent. in the fat determination therefore meant a loss to the producer of more than 40,000 pounds of butter fat, if the "glymol" method was used in all cases. The value of this fat was approximately $20,000. The reading error has been found to vary according to the method of adding the oil. If the latter is added slowly and carefully, little or no error occurs. If the oil is run in rapidly, as is ordinarily the case, it momentarily sinks into the liquid butter fat, and as it rises it carries some of the latter upon its surface, thus decreasing the length of the residual fat column. It is conclusively shown that the method is not safe in the hands of the average dairy tester, but the use of amyl alcohol for this purpose, substituted for hydrocarbon oils, gives reliable results in all cases.

The commercial purification of phosphoric acid by crystallization: WILLIAM H. ROSS, C. B. DURGIN and R. M. JONES. Commercial phosphoric acid contains among other constituents such poisonous impurities as lead, arsenic and fluorine. Acid intended for use in the manufacture of foodstuffs must therefore be treated for the elimination of these materials. This is done, at present, by precipitation with the aid of suitable reagents. The effectiveness of this method is limited by the solubility of the precipitate in the acid. It has been found that by concentrating phosphoric acid, at a temperature below 105°, to a specific gravity of 1.85 at 20° and inoculating with a crystal of phosphoric acid, the greater part of the acid will crystallize, leaving the impurities in the mother liquor. The crystallization may be repeated by centrifuging, melting the crystals at a temperature above 40° C., cooling to ordinary temperature, adding water to bring to a specific gravity of 1.85 and again inoculating. Two or even one crystallization will usually be sufficient for acid of commercial quality, but by repeated crystallizations acid of any desired degree of purity may be obtained. When phosphoric acid is prepared by the volatilization process and collected in a Cottrell precipitator, it is usually of such a concentration that it may be crystallized with little or no initial concentration. The crystallization method is therefore especially adapted to the purification of volatilized phosphoric acid and experiments on the commercial development of the method are now in progress.

Do velvet beans contain vitamin B? E. R. MILLER. Fourteen pigeons were fed on an exclusive diet of polished rice until pronounced symptoms of polyneuritis appeared. Seven of these were restored by feeding each five grains of corn. The other seven were fed five velvet beans each with the result that all were improved temporarily, but all died within two to six days. Of another group of six which were fed polished rice, two died, apparently from starvation. Of the four brought down with polyneuritis, three were completely restored by administering to each 0.5 grams of an alcoholic extract of velvet beans and one was partially restored. This amount of extract represented three beans of average size. The more favorable results obtained with the second group is probably due to the greater availability of the vitamin and is believed to show that the velvet beans contained a fair amount of vitamin B.

The occurrence and composition of some Alabama phosphates: B. B. ROSS.

The mineral requirements for the nutrition of wheat during the seedling phase: H. H. KING and M. C. SEWELL. Wheat was grown in sand cultures, the nutrient solution consisting of KH_2PO_4, $Ca(NO_3)_2$ and $MGSO_4$ and the concentration of the salts in each pot having a calculated osmotic value of 1.00 atmosphere but differing by increments of ⅛ in salt proportions. The pots were arranged in duplicate triangles of twenty-one pots each. The experiment was carried through the seedling phase of five weeks' length. Solution R_4S_2 which was chosen as best consisted of KH_2PO_4, $Ca(NO_3)_2$ and $MgSO_4$ in the following proportions, 3:2:3, and the respective partial volumes molecular concentrations being 0.0072, 0.0048, 0.0072. The basis for the determination of the best solution was the dry weight of tops. To five pots vitamines extracted from yeast was added. This increased the growth of the plants quite noticeably.

A dietary study of some state institutions: E. H. S. BAILEY. This is a study of the dietary of each of the groups at the different institutions under the care of the Kansas State Board of Administration, where shelter, food and clothing are provided. The calculations are made from a complete report of all the food used for a series of months, sometimes during the entire year. The proteins, fats and carbohydrates and the calories per day per capita are worked out for each institution according to a commonly accepted method. The number of inmates at these institutions being large, and the conditions varied, an excellent opportunity is afforded for a comparison and for constructive criticism on the quantity, variety and cost of the food furnished.

Studies on the electropure process of treating milk: FLOYD W. ROBISON. This paper gives a résumé of previous work on the treatment of milk by electricity and gives in detail the results of the author's studies on the improved apparatus. The apparatus is described in detail and its essential characteristics emphasized. Results of studies on bacterial reduction; keeping qualities of the treated milk; effect on cream line, etc., are given and include a very thoroughly conducted experiment on the effect of the process on bacteria of tuberculosis in milk. The great value of the process is pointed out and certain automatic control features dwelt upon. The application of the electric current and the method of preventing the electrodes from becoming hot, thus eliminating any heated taste, are important features in the light of their effect on the treated milk. The process produces a milk free from pathogenic organisms and with a phenomenal bacterial reduction. The keeping quality of the treated milk is excellent and its commercial values otherwise greatly enhanced. The apparatus is illustrated.

The rôle of manganese in plants: J. S. MCHARGUE. The purpose of this investigation was to determine if manganese has any definite function to perform in plant economy. The method of attack has been the preparation of plant nutrient compounds and quartz sand, free from manganese, and the growing of plants in different portions of nutrient solutions or sand cultures from which manganese was withheld and in another equal number of portions of these media to which manganese was added. All the plants were grown until those that received manganese showed signs of fructification and a few to maturity. The plants from which manganese was withheld made a normal growth for about six weeks only. Thereafter they became chlorotic and the young leaves and buds died back and the plants made no further growth of any consequence, whereas the plants to which manganese was available grew in a normal way and fructified where the plants were grown to that state of maturity. The author concludes that manganese is necessary in the plant economy and that, therefore, eleven elements are necessary for the normal growth of autotrophic plants, whereas it has been taught previously that only ten are necessary.

The absorption of water by soil colloids: W. O. ROBINSON. A method is given for determining the amount of water absorbed by the air-dried colloid under specified conditions. It was found that the water absorbed by purified colloids from thirty-five different soils was nearly a constant, the average being .298 grams of water absorbed per gram of colloid. A tentative method is proposed for determining the amount of colloid in a soil by finding the amount of water absorbed and dividing this figure by .298. The assumptions involved are discussed.

DIVISION OF PHYSICAL AND INORGANIC CHEMISTRY

S. E. Sheppard, *chairman*
R. E. Wilson, *secretary*

Theory of the structure and polymorphism of silica: ROBERT B. SOSMAN. There exists a wide variety of experimental data on the forms of silica, and particularly on quartz, which have never been assembled and explained on the basis of a single consistent set of hypotheses as to the ultimate structure of this substance. This paper attempts to provide such a set of hypotheses, based upon the general knowledge already gained concerning the structure of matter in general and silica in particular. It is believed that the silica atom-triplet maintains a certain degree of individuality in its amorphous and crystalline states as well as in its compounds, and the freedom of its oxygen atoms to change their positions with respect to the silicons is restricted. The triplets are assumed to assemble into chains or threads in the liquid and glassy states, and a thread structure persists in the crystalline states (cristobalite, tridymite, chalcedony, quartz). The high-low or alpha-beta inversions in all the forms are thought to be due to the same underlying change, namely, a change in the shape of the silicon atom and in the relative positions of the two oxygen atoms attached to it.

A general conception of acids, bases and salts: Hamilton P. Cady and Howard M. Elsey. General definitions are suggested for acids, bases and salts which it is believed will include all systems whether containing hydrogen as one of the constituents of the solvent or not. According to this view, an acid is defined as a substance which ionizes to yield the same cation as is given by the direct ionization of the solvent. A base is a substance which, by its direct ionization, yields the same anion as the solvent. General definitions may be easily derived for salts, neutralization, hydrolysis and other terms. These definitions are applied to solutions in sulfur dioxide.

Crystallography and atomic structure: Edgar T. Wherry. Instead of treating crystal structure from the viewpoint of point-systems, it is desirable for some purposes to consider the atomic domains, or spaces, with which each atom acts. The most important domains which are geometrically possible are figured, and summaries given of the elements known to possess each. It is held that in any atom in the crystalline state the electron arrangement possesses the same symmetry as the domain within which that atom lies. The structures on the basis of Langmuir's synthesis of earlier theories and of Bury's modification of it are compared with the simplest possible structures reconcilable with the geometrical requirements. It is thought that in some atoms the two electrons of the helium nucleus are not stationary, but revolve so as to produce a spherical external field of force. From lithium up to calcium the arrangements are simply related to those accepted by both Langmuir and Bury, but in the elements of higher number the arrangements suggested by Langmuir are not capable of passing into those fulfilling the geometrical requirements as readily as are those of Bury. The conclusions as to the simplest structures reconcilable with the domain symmetry in the cases of most of the elements of which the domains are known are shown in a final tabulation.

Equilibrium in the reduction of iron oxides and in the oxidation of iron by steam: A. S. Richardson, F. C. Vibrans and W. P. Bell. Equilibrium in the systems H_2-H_2O-Fe-FeO, H_2-H_2O-FeO-Fe_3O_4, CO-CO_2-Fe-FeO, and CO-CO_2-FeO-Fe_3O_4, have been commonly supposed to apply to the reducing and steaming phases of the steam-iron process of hydrogen manufacture. The literature on these equilibria is itself conflicting, but in still worse agreement with the authors' observations on the first stages of both reducing and steaming the iron contact mass used in hydrogen manufacture. Higher conversion of steam to hydrogen and higher conversion of reducing gases to oxidized gases have been obtained than the equilibrium data indicate to be possible.

Solubility measurements on sulfur dioxide: Stewart J. Lloyd. The solubility of sulfur dioxide was determined in naphthalene, acetone, ether, ethylene bromide, butyric acid, ethyl acetate, trichloracetic acid, carbon tetrachloride and chloroform. Distinct irregularities were observed with trichloracetic acid, chloroform and carbon tetrachloride, and a further study of them is under way.

Esterification equilibria in the gaseous phase: Graham Edgar and Wm. H. Schuyler. The equilibrium in the gaseous phase between acetic acid, alcohol, ethyl acetate and water has been measured by distilling a small amount of vapor from the liquid equilibrium mixture, chilling and analyzing. The composition of the distillate differs widely from that of the liquid. Calculations of the equilibrium constant in the gaseous phase are complicated by the partial association of the acetic acid, but indicate a much more complete esterification than in the liquid phase. The results are in accord with qualitative results of Berthelot and Pean de Saint Gilles, and have an important bearing upon the high yields of ester obtained by Reid when passing alcohol and acetic vapor over silica gel.

Partition ratios and solubility numbers: N. E. Gordon and E. Emmet Reid. Formic acid has been partitioned between water and a number of organic solvents in which the solubility of formic acid has been determined. From the partition ratios and the solubilities an attempt has been made to estimate the tendency of formic acid to dissolve in water.

The amphoteric ionization of hypochlorous acid: William A. Noyes and Thomas A. Wilson. The ionization constant of hypochlorous acid as an acid was determined by measuring its conductivity in 0.001 normal solution and also the conductivity of solutions 0.001 normal for sodium hypochlorite and for calcium hypochlorite, prepared by mixing a solution of pure hypochlorous acid with solutions of the respective bases. The solution of hypochlorous acid was prepared by distilling, under diminished pressure, chlorine water in contact with yellow mercuric oxide. The ionization constant found was between 6.60 and 6.79×10^{-10}, a value somewhat smaller than that of Sands calculated from entirely different data. No measurable difference could be found between the conductivities of 0.001 and 0.0001 normal nitric acid and the conductivities of solutions which were 0.001 or 0.0001 normal for both nitric and hypochlorous acids. In other words, the ionization of hypochlorous acid as a base, to positive chlorine and hydroxyl ions, can not be shown by this method. It was shown by determining the composition of the vapors carried away from solutions of pure hypochlorous acid by a current of air that these contain chlorine monoxide, Cl_2O, and not hypochlorous acid, HClO. The chlorine monoxide is evidently formed by the union of positive chlorine ions with hypochlorite ions, showing very clearly the amphoteric ionization of the acid. Jakowkin has shown by the freezing point lowering that solutions of hypochlorous acid contain chiefly the unionized acid.

The ionization of butyl mercuric hydroxide: W. V. Evans and Louise Otis. It is generally stated in the literature that substances of the type RHgOH are strong bases, but no experimental data exist. Preliminary conductivity measurements show that butyl mercuric hydroxide is a weak base. Because of its hygroscopic nature weighing out samples is unsatisfactory. Ordinary titration of the base offered difficulties which were overcome by adding sodium chloride, thus precipitating out butyl mercuric chloride and leaving NaOH to be titrated. Molecular weight determinations by the freezing point method showed ionization varying from about 10 per cent. in .1N solution to about 40 per cent. in .02N. This preliminary study has shown several interesting properties of the base. A trace of the base in water changes the surface tension of the water in such a way that the solution does not wet glass. A solution of butyl bicarbonate on boiling loses all of its carbon dioxide, leaving a solution of the pure base.

Ammono nitric acid: Edward C. Franklin. Assuming a structure represented by the formula $\mathrm{H{-}N{=}N{\equiv}N}$ hydrazoic acid may be looked upon as a nitric acid of the ammonia system. In agreement with this view it has been found first, that a mixture of hydrazoic acid and hydrochloric acid dissolves the noble metals; second, that sodium oxide (sodium ammono nitrate) nitridizes sodium cyanide (sodium ammono carbonite) to sodium cyanamide (sodium ammono carbonate); third, that potassium nitrate (potassium aquo nitrate) may be ammonolyzed to potassium oxide (potassium ammono nitrate); and fourth, that nitrous oxide (a mixed acid anhydride acid anammonide) reacts with potassium hydroxide to form potassium nitrate.

The drainage error in viscosity measurements of viscous materials by the capillary tube method: Eugene C. Bingham and H. L. Young. Tests with bulbs of 8 to 24 ml capacity show that the amounts of liquid left on the wall of the bulb for a given time of efflux are nearly independent of the size of the bulb, but they are directly in proportion to the viscosity of the liquid. The authors have constructed a tube which shows the drainage correction for any particular viscosity at the different rates of efflux.

Hydrogen ion concentration and the properties of the emulsoid colloids: Robert H. Bogue. It is shown that the various physical properties of the emulsoid colloids, as viscosity, jelly strength, melting point and joining strength (of glues) are at a minimum at a hydrogen ion concentration corresponding to the isoelectric condition. As the acidity or the alkalinity of the solution is increased from this point, these properties rise in value to certain maxima. It is shown that salt precipitations for gelatin content should be made at the isoelectric condition if maximum precipitation is desired. The necessity for a careful control of hydrogen ion concentration in investigational work on the emulsoid colloids is emphasized, and the desirability of a similar control in the plant during manufacture is pointed out. The limitation of benefit from such control makes questionable, however, the practicability of such methods for the purpose of the improvement of grade. The estimation of hydrogen ion concentration as one of the tests in evaluation is urged, but it is not recommended that all tests for viscosity, jelly strength, etc., be made at a specified p_H value.

The elasticity of ash-free gelatin jellies: S. E. Sheppard and S. S. Sweet. In an earlier paper on "The elastic properties of gelatin jellies" the authors gave results on the measurement of the modulus of rigidity of gelatin jellies from commercial gelatins, at various concentrations and p_H values. Certain anomalous results were obtained on variation of p_H. It was suspected later that these anomalies might depend upon the (inorganic) ash constituents, and elastic measurements have been repeated on carefully de-ashed gelatin at various concentrations and p_H values. The new results show that for this purified gelatin a maximum of rigidity (jelly-strength) is obtained at about $p_H = 8$, at all concentrations; the curves show a "shoulder" near the isoelectric point ($p_H = 4.8$) but no definite maximum or minimum. On adding aluminum salts, to give as low as .01 per cent. Al_2O_3 on dry gelatin, the course of the curve was greatly altered, a secondary maximum being produced at $p_H = 5$, and the maximum on the alkaline side displaced.

The formation of inorganic jellies: general theory: Harry B. Weiser. Factors that influence the formation of jellies in general are: A jelly may be expected to form if a suitable amount of a highly hydrous substance is gotten into colloidal solution and allowed to precipitate at a suitable rate without stirring. If the concentration of the hydrous substance is too low, no jelly or only a very soft jelly can result. If the precipitation from colloidal solution is too rapid, contraction is likely to occur with the formation of a gelatinous precipitate instead of a jelly; if too slow, the particles are likely to grow and settle out in a granular or sandy mass. The effect of the presence of salts on jelly formation is determined by the agglomerating and stabilizing action of ions, in so far as these affect the rate of precipitation.

The adsorption and orientation of molecules of dibasic organic acids and their ethereal salts in liquid-vapor interfaces: H. H. King and R. W. Wampler. Adsorption values are given for oxalic, malonic, succinic, fumaric, maleic and d tartaric acids and the di-ethyl esters of all the above acids with the exception of oxalic and maleic. The values were calculated using Gibbs' equation. Hydroxyl groups and double bonded carbons increase the surface tension, as is shown by the fact that d tartaric acid has the highest surface tension, and in order maleic malic to succinic, which has the lowest. The higher surface tension of the acids as compared with the esters is due to their polarity. The influence of the polar groups in the esters is similar. The esters are adsorbed more than the acids due to the replacement of the polar groups with the insoluble ethyl group. The molecules are orientated so that the polar groups are in the liquid leaving the carbon chains in the surface. Tartaric acid is negatively adsorbed, the surface tension of an 8 M solution being 74.125 and a .125 M solution being practically that of water.

The atomic weight of lanthanum: B. S. Hopkins and F. H. Driggs. The lanthanum from 182 kg. of cerium group double sulphates was purified by fractional crystallization of the double magnesium nitrates until free from neodymium followed by fractional crystallization of the double ammonium nitrates. The arc and absorption spectra of the insoluble end of this series showed it to be free from all other rare earths. The material was further purified by eight alternate precipitations with ammonia and oxalic acid. The pure oxide was converted to the chloride in a quartz flask with pure dry HCl and weighed. A nearly equivalent amount of pure silver was weighed out, dissolved in HNO_3 and added to the solution of $LaCl_3$. The deficiency of silver or chloride was added from a standard solution of $AgNO_3$ and NaCl. Equivalence was tested for with the nephalometer. From the ration, $LaCl_3 : 3Ag$, the atomic weight of La was calculated. The average of five determinations was 138.91.

Thermo-regulator: E. B. Starkey and Neil E. Gordon. A thermo-regulator, designed to meet the needs of the individual student in physical chemistry. It has an accuracy to .05° C., and does not require a relay or battery. Furthermore, the point of contact is enveloped in an atmosphere of inert gas, and hence there is no oxidation at the point of contact.

The concentrations of alkali halide solutions of the order of 0.0001 N most favorable to adsorption by barium sulphate: Jack P. Montgomery. Each halide was used in concentrations progressing from 0.00004 N to 0.001 N in a series of 50 cc cylinders each containing 0.01546 gram barium sulphate. The upper half of each solution was withdrawn for titration with 0.004 N silver nitrate. There was a regular progression of the volume of silver nitrate required until a certain concentration of the halide was reached, at which concentration less than the expected volume was required. Having passed this concentration the progression became regular as before. Plotting the halide adsorbed against the concentration, the curves are regular except for a dip at the point showing the most favorable concentration. Favorable concentrations are LiCl, 0.00088 N; NaCl, 0.00072 N; KCl, 0.00034 N; RbCl, 0.00014 N; LiBr, 0.00068 N; NaBr, 0.00056 N; KBr, 0.00016 N; LiI, 0.0001 (?).

The transposition of insoluble oxalates by sodium carbonate solution: L. J. Curtman and D. Hart. Working under the most favorable conditions for the transposition of calcium oxalate by sodium carbonate solution, it was found that 91 per cent. was transposed. With the oxalates of barium, strontium, ferric and ferrous iron, aluminum, nickel, cobalt, manganese, zinc, bismuth, copper and stannous tin, a transposition of 98 to 100 per cent. was obtained. The oxalates of calcium, magnesium, lead and cadmium were transposed from 91 to 97 per cent. Silver oxalate on the other hand was transposed only to the extent of 77 per cent. In determining the amount of transposition it was necessary to analyze the insoluble oxalates for their oxalate content. In this work it was necessary to devise special procedures wherever the oxalate content could not be directly determined as in the cases of ferrous, cobalt, lead and stannous oxalates. These special procedures are given in the original article.

A new method for the volumetric determination of iron: L. J. Curtman and N. H. Hecht.. In a previous communication (*Chem. News,* CXXII, 1921, p. 254) the authors proposed a rapid method for roughly estimating the iron in systematic qualitative analysis. In this method the iron, if not already in the ferric condition, is first oxidized, treated with KCNS and the deep-red $Fe(CNS)_3$ which form is bleached with a standard solution of $SnCl_2$. The results obtained by this method were so surprisingly accurate that we undertook a special study of the procedure to determine whether or not it could be used as a substitute for the standard volumetric methods for iron. Numerous analyses of iron ores were made by our method as well as by the Zimmerman-Rheinhart and gravimetric methods. The results agreed very well, showing the new method to be a reliable one. The various factors which influence the results by this method were studied and a suitable apparatus was devised for preventing the oxidation of the standard $SnCl_2$ solution. Once the apparatus is set up, our method will be found much more rapid of execution than any of the old volumetric methods in which the iron is first reduced and then oxidized.

Two new pieces of apparatus for use in analytical work: Louis J. Curtman. Having experimentally demonstrated that 48 per cent. HF was without appreciable action on transparent bakelite, the author had prepared for him from this material a 10 cc graduate and a medicine dropper. The former has been found very serviceable in measuring definite quantities of HF. These graduates are less brittle than glass, they are noninflammable, retain their shape and can be readily cleaned. They are provided with a flared top to facilitate pouring the HF from the usual wax containers in which HF is supplied. The medicine dropper made of transparent bakelite has been found superior to the improvised lead tubes which have heretofore been used in carrying out one of the best qualitative tests for silica and silicates.

Rapid electrolysis without mechanical stirring: Graham Edgar and R. B. Purdum. By the use of an electrolytic cell consisting of a wide glass tube provided with three glass "air lifts" sealed into its side and entering tangentially at their upper ends, a vigorous stirring, both rotational and vertical, may be effected by blowing or sucking an air current through the air injectors. With a cylindrical platinum gauze cathode and a spiral anode in such a cell, rapid and accurate determinations of copper have been made, using a current of as much as three amperes and a time as low as fifteen minutes. Zinc does not interfere. The apparatus is readily constructed, and the technique for its use is extremely simple.

The relation of yield value and mobility to the so-called painting consistency of paints: Eugene C. Bingham and Herbert D. Bruce.

Hydroux oxide IV: Hydrous Stannic Oxide: Harry B. Weiser. The so-called alpha or stannic acid and beta or metastannic acid are not isomeric compounds but are the two extremes of a series of hydrous stannic oxides that differ from each other in solubility, peptizability, adsorbability, the structure of the mass and the amount of water contained. Peptization and adsorption experiments on stannic oxides prepared at various temperatures show that each is a chemical individual and not a mixture of a definite alpha with a definite beta oxide. Contrary to the usual observation, stannic oxide jellies may be prepared by precipitation of the hydrous oxide from colloidal solution, under suitable condition.

The interfacial tension between toluol and ash-free gelatin solutions: S. E. Sheppard and S. S. Sweet. Measurements were made by means of a drop pipette, the interfacial tension being calculated from the weight of a drop by Harkin's formula, the accuracy being checked by measurements on water. It is found that gelatin lowers the interfacial tension between water and toluol considerably, a one per cent. at 30° C. lowers it some 10 dynes/cm, and this increases with the concentration of gelatin. The interfacial tension or p_H curve was determined for 1.0 per cent. ash-free gelatin at 30°, 40° and 50°. Between $p_H = 1$ and $p_H = 10$ there is but little variation, except for a well-marked and significant "kink" at $p_H = 4.8$, the iso-electric point. At 30° and 40° C. there is but little change with time, but at 50° C. the change is considerable, except at the iso-electric point, indicating hydrolysis.

The nitration of toluene: James M. Bell.

Charles L. Parsons,
Secretary