THE AMERICAN CHEMICAL SOCIETY

DIVISION OF PHYSICAL AND ORGANIC CHEMISTRY

(Continued from November 17)

The conductivities, viscosities and densities of solutions of mixed electrolytes. (Lantern): C. E. Ruby and J. Kawai.

The mutual solubility of liquids: Two new methods for determining the same: Arthur E. Hill. The published results on the solubility of liquids are meagre compared with the voluminous data on the solubility of solids. It is proposed to study a number of new cases, and repeat some determinations which appear to be inaccurate. No methods have proved to be of universal applicability. In place of the terms synthetic and analytic methods, which do not indicate the essential differences in procedure, the term thermostatic is proposed for methods in which the temperature is held constant and plethostatic for methods in which the concentration is fixed and the temperature changed to the point of beginning heterogeneity or homogeneity. As a new thermostatic method suitable to liquids of moderate solubility, the measurement of the volumes obtained in suitable volumetric apparatus in two experiments may be used, on the basis of the phase rule, to calculate the solubilities. An accurate determination of the solubility curves for ether and water has been made by this method. For liquids dissolving very small amounts of water the use of silver perchlorate is proposed; the solubility of this salt rises sharply with the presence of small amounts of water, so that, after establishment of a reference curve at a standard temperature (25°), the solubility of water at any other temperature can be determined. The solubility of water in benzene and in aniline has been measured by this second method.

The occurrence of closed solubility curves in three-component systems: Arthur E. Hill. Closed solubility curves have been found in several two-component systems, such as nicotine and water. Among three-component systems the closed curve has been found only once, in the case of silver perchlorate, water-benzene, recently published by the author. The same type of curve has now been found in the system silver perchlorate-water-toluene, and exists from room temperature to some temperature above 100°. In both these cases, the curve for the two component systems (silver perchlorate-benzene and silver perchlorate-toluene) approaches a perpendicular to the temperature axis, *i. e.*, the two components just fail of breaking into two liquids; the addition of the third component evidently decreases the mutual solubility, causing the formation of two liquid phases. It is well known that, when there is limited solubility of two liquids, a third component may either increase or decrease that solubility. Where there is unlimited solubility of two components in the fused state (*i. e.*, only one liquid phase exists), the addition of the third component should again act either to increase or decrease miscibility; but if the two-component system shows a nearly perpendicular curve, indicating that the forces existing are only just sufficient to hold the two components in solution, a third component chosen to reduce mutual solubility should result in a separation into two liquid phases, which, in the three-component diagram, leads to a closed curve. We may therefore look for closed curves in three-component systems most hopefully where one of the two-component systems shows a solubility curve of the type described.

Solubilities up to the critical temperature: P. A. Bond and M. C. Waddell. I—Methods of manipulation. II—Solubilities in sulfur dioxide at 25° C. A method for determining solubilities up to the critical temperature has been developed. The apparatus and method of manipulation are discussed. Solubilities in sulfur dioxide at 25° C. have been determined for salts of potassium, silver, cadmium, tin, antimony, tellurium, manganese and in one case for Ba as the thiocyanate. Aside from the solubilities as determined, interesting reactions between sulfur dioxide and chlorates, bromates, iodates and nitrates were noticed. Also a double layer was formed in the case of SnBr. Work is to be continued until salts of all metals have been tried, and in cases where solubility is shown is to be carried on at different temperature levels.

Vapor pressures of certain hydrated sulfates: Clifford D. Carpenter and Eric R. Jette. The vapor pressures of some of the hydrated sulfates of Cu, Mn, Mg, Co, and Cd have been studied at a number of temperatures below the transition points, and the saturated solutions of some of them at several temperatures above these points. Some of the determinations have been carried as high as 90° C. A modification of the Bremer-Frowe tensimeter was used. All points were determined by approaching equilibrium from both a higher and a lower pressure. A special thermostat was constructed for the higher temperatures. The results obtained have been used in plotting the vapor pressure curves, in calculating the heats of vaporization, and for plotting the log $p - \frac{1}{T}$ relation. The log $p - \frac{1}{T}$ relation gave straight lines in every case, and these lines intersected sharply at the transition points. Some transition points are definitely located by the intersection of the vapor pressure curves. There are certain limitations in using vapor pressure data for interpreting the nature of the phenomenon.

Electroadsorption as a pure chemical phenomenon: J. W. Elder, E. B. Starkey and N. E. Gordon. An investigation to throw more light on the relation between electroadsorption and pure chemical action. The work was carried out with the hydrogels of ferric oxide and silica acting as the adsorbents. Such salts were used so as to have the resulting products of different solubility provided there was a chemical reaction. The electroendosmosis of each system was investigated in order to correlate, if possible, any electrochemical behavior.

Adsorption by activated sugar charcoal. II: F. E. Bartell and E. J. Miller. This paper presents the results obtained in a study of the nature of adsorption of electrolytes from solution by activated ash-free sugar charcoal. It includes data on the adsorption of acid dyes, basic dyes, organic and inorganic acids and inorganic bases. A brief discussion of the theory of hydrolytic adsorption of electrolytes is given, followed by a consideration of results obtained with a number of salt solutions with activated sugar charcoal. The variation of these results from those obtained by other investigators who have used charcoals of animal or vegetable origin is pointed out.

The influence of temperature pressure and catalyst support material upon adsorption by catalytic nickel: A. W. Gauger and Hugh S. Taylor. (1) Adsorption isotherms of hydrogen on nickel have been determined, using nitrogen as a reference gas. A definite saturation capacity of nickel for hydrogen exists, dependent upon the temperature; (2) From the variation of the saturation pressure with temperature the heat of adsorption of hydrogen on nickel has been calculated to be approximately 2,500 calories; (3) The effect of using an inert material for catalyst support has been found to increase greatly the adsorptive capacity per gram of nickel and to yield a catalyst that will stand much more severe heat treatment without diminution of its adsorbing power.

An instrument for measuring the rate of swelling of gelatine films on rigid supports: S. E. Sheppard and Felix A. Elliott. An instrument was described which consists essentially of a balance beam resting upon a fulcrum which can be raised and lowered by means of a micrometer screw. At one end of the balance beam hangs a slender but rigid quartz rod, the end of which is flattened to form a foot ca. 2 mm. in diameter. The weight of this rod is carefully counterbalanced within a few mgs., allowing just enough ''out of balance'' to insure constant but practically weightless contact between the foot and the swelling gelatin surface. The gelatin coated plate is securely clamped in a jacketed tray just below the quartz rod. An optical system indicates the condition of balance, the fulcrum is lowered until balance is indicated, a reading made, and solution acting on the gelatin poured in the tray and the fulcrum raised as may be necessary to maintain balance. Readings are made periodically. The sensitivity is about 0.001 mm. and the precision 5 to 1 per cent., depending upon the rigidity of the jelly. Measurements have been made using glass plates coated with gelatin and also emulsion coated plates. These were swollen in acids and alkalis as well as salt solutions and photographic developing baths. Although differing in degree all curves indicated a rapid initial swelling asymptotically approaching an equilibrium.

The effect of gravity and light on the formation of Liesegang bands in gelatin and silicic acid. (Illustrated): Earl C. H. Davis. Gravity has but little effect on the formation of periodic bands in gelatin as shown experimentally. Light is one of the most important variables in making rhythmic bands of gold in silicic acid. At the concentrations used no bands were formed in the dark at either 0° C. or at room temperatures. Periodic variations of strong light and darkness produce bands in those regions in which there is still adsorbed molecular gold, excess oxalic acid and suitable amounts of the products of the reaction. These by-products make precipitation in bands possible because they influence the tendency toward imbibition and peptization so that the gold is precipitated in ''pockets'' just large enough to give a colloidal dispersion. There is no fundamental difference between the bands of blue gold and those of red. The location of the colloidal bands can be governed by a black paper which surrounds the tube and has slits cut in it at regular intervals. With a Mazda light placed near such a tube in the dark room for a week the bands at the openings are coarse particles instead of being colloidal. That is, they are yellow crystals. Contrary to some previous observations rhythmic bands of the silver chromate form in darkness at 0° C. and room temperatures.

Ferric oxide hydrosol. II. The chlorine and hydrogen ion activities and the heat of coagulation with sodium sulfate: FREDERICK L. BROWNE. A study has been made of the hydrogen and the chlorine ion activities in ferric oxide hydrosol and in hydrolyzed and unhydrolyzed ferric chloride solutions. From these data the distribution of $FeCl_3$ and HCl between the dispersed phase and the dispersion medium has been computed. When the heat of coagulation of these sols with Na_2SO_4 is corrected for the heat of mixing of Na_2SO_4 with the $FeCl_3$ and HCl present, there is left a small positive heat effect which is proportional to the amount of Na_2SO_4 adsorbed during coagulation and amounts to about 1,200 cal. per g. eq. Na_2SO_4 adsorbed.

Ferric oxide hydrosol: ARTHUR W. THOMAS and ALEXANDER FRIEDEN.

A note on quinaldine pink: HANS T. CLARK and FELIX A. ELLIOTT.

The coagulation and repeptization of colloidal ferric hydroxide by alkalis: ROBERT E. WILSON and PHILIP S. CLARK. In order to improve the efficiency of removal by filtration of small amounts of colloidal ferric hydroxide from hot water which has been passed over sheet iron to remove dissolved oxygen, a study was made of various possible coagulating agents for ferric hydroxide. It was found that alkalis were by far the most effective precipitating agents in small amounts, and that as low as .05 per cent. NaOH effected practically complete coagulation in a very short time. *Larger* amounts of alkali were found to *decrease* the efficiency of filtration, and this behavior was eventually shown to be due to the repeptization of the ferric hydroxide as a *negative* colloid, with markedly different properties.

Gum dammar as an emulsifying agent: HARRY N. HOLMES and DONALD CAMERON. Since gum dammar is insoluble in water but soluble in many other liquids its use as an emulsifying agent forces water to become the internal or dispersed phase in the "water-in-oil" type of emulsion. Such emulsions are more stable and may be made much richer in water than by the use of calcium soaps. Salve-like emulsions are readily made by mixing a solution of the gum in benzene with a relatively large amount of vaseline or heavy oil and then rubbing in the desired amount of water. Printers' or lithograph inks may be greatly cheapened by the incorporation of water, dispersed in minute drops, by the use of this gum as emulsifying agent. Since much of the drying oil is used merely to give a proper working body, the use of water, well emulsified, will give the requisite body more cheaply while a smaller amount of the drying oil is adequate for adhesive purposes. Paints, varnishes and greases may be diluted in similar fashion.

Cupric oxide jellies and the general theory of jelly formation: HARRY B. WEISER. A dilute colloidal solution of hydrous cupric oxide is formed by adding ammonia short of precipitation to a saturated solution of cupric acetate. This colloid coagulates on standing, forming a gelatinous precipitate of the hydrous oxide. By adding a suitable small amount of sulfate to the acetate solution before adding ammonia, a more concentrated colloidal solution of hydrous cupric oxide may be prepared. This colloid is likewise instable and, under suitable conditions, coagulates with the formation of a stable jelly. The sharply defined conditions of formation and the effect of electrolytes on the stability and rate or precipitation of the colloidal oxide support the author's general theory of the formation of inorganic jellies proposed at the Birmingham meeting.

A rapid method for the preparation of some dilute silica gels: L. H. REYERSON and WM. T. MORIN. It has been found that ammonium hydroxide solutions will under certain conditions cause solutions of sodium silicate, mixed with hydrochloric or sulfuric acids, to set to gels. Using this method it has been possible to set gels with an SiO_2 concentration as low as approximately one half of one per cent. Gels as low as two per cent. will set almost instantly. The characteristics of these dilute gels are being studied.

Studies on the nature of the reducing action of charcoals on certain salt solutions. I. Silver nitrate: L. H. REYERSON and MAX LATSHAW. The reducing action of various charcoals upon silver nitrate solutions has been studied. An almost ashless charcoal was prepared in order to eliminate the interferences due to impurities. Neutralization of surface charges does not account for the reduction to metallic silver. Evidence from Hulett's work as well as our own investigations points to the fact that an active form of hydrogen, strongly adsorbed by the charcoal, is the reducing agent. Silica gel outgassed at 400 C. and cooled in an atmosphere of hydrogen reduces silver ion in silver nitrate solutions to silver. This reaction is being studied in its effect on various cations, especially those which lie below hydrogen in the electromotive force series.

Behavior of aqueous potassium permanganate in the presence of potassium hydroxide: WILLIAM LERCH and J. E. DAY. The rate of decomposition of an aqueous solution of potassium permanganate (free from reducing substance) in the presence of varied amounts of potassium hydroxide (free from reducing substances) was observed at the temperatures 75 and 105° Centigrade (approximately) For a concentration of KOH at and below 0.7 M no change in oxidizing potential occurred at 73° in 182 hours. Increasing temperature and alkalinity resulted in an increase in the per cent. of $KMnO_4$ converted to K_2MnO_4. At 105° Centigrade and a causticity of 11.7 M the percentage change was 90.3. The rate of change curves are log curves.

Some properties of arsenic trioxide in aqueous solution: ERNEST ANDERSON and R. G. STORY. The density and refractive index curves of As_2O_3 in aqueous solution were found to be straight lines. The equation for such a curve is: $W = A + BX$. The constants A and B for both curves were accurately determined at 25° C. The weight of As_2O_3 calculated from either density or refractive index by the constants A and B agree exactly with analytical determinations. The solubility curve, degree of hydration and hydrogen ion concentration were also determined for As_2O_3 in aqueous solutions.

Preparation of antimony-free arsenious trioxide: C. W. FOULK, P. G. HORTON and G. M. MCCLURE. Arsenious trichloride is first prepared either by heating the oxide with concentrated hydrochloric acid and distilling or by adding sulfuric acid to the hydrochloric acid solution and drawing off the layer of trichloride. The separation from antimony can be effected by several distillations of the arsenious trichloride or better and easier by shaking the trichloride two or three times in a separatory funnel with a little less than its own volume of concentrated hydrochloric acid. The antimony goes into the water-acid phase.

The determination of lead in lead amalgam: M. G. MELLON. Lead in lead amalgam may be displaced by copper from an aqueous solution of copper nitrate with the formation of copper amalgam and lead nitrate. The lead may then be precipitated and weighed as the chromate. Data are given to show the accuracy of the method and the effect of time, temperature and concentration of copper nitrate upon the displacement reaction. The mercury is not dissolved in the determination, and it may be purified for further use.

The volumetric determination of phosphorus: WILLIAM A. TURNER. Experiments undertaken using the Pemberton or Kilgore volumetric method for phosphorus show a positive error of approximately 8 per cent. when compared with results obtained by the gravimetric method. It is shown that the factor for the phosphorus equivalent of the alkali solution as given in the official methods of the A. O. A. C. and in many textbooks is derived from an incorrect reaction. The precipitate of ammonium phosphomolybdate as ordinarily produced contains acid not removed by washing with a neutral salt solution. The precipitate, therefore, is not $(NH_4)_3PO_4 . 12MoO_3$, as commonly assumed, but $(NH_4)_3PO_4 . 12MoO_3 + 2$ mols. HNO_3 or an equivalent amount of some other acid. Such a precipitate requires a larger proportion of alkali. The correct reaction is, $2[(NH_4)_3PO_4 . 12MoO_3 . 2HNO_3] + 50NaOH = 2(NH_4)_2HPO_4 + (NH_4)_2MoO_4 + 23Na_2MoO_4 + 4NaNo_3 + 26H_2O$. A factor calculated on this basis calls for an 8 per cent. reduction in the phosphorus equivalent of the alkali solution. Such a factor gives results which agree very closely with the gravimetric method.

Note on apparatus for preparation of conductivity waters: C. W. FOULK and A. P. BAWDEN. The device is an accessory for conductivity water stills because its use eliminates corks or rubber stoppers for connecting glass flasks with condensers. Briefly, it consists of a circular tin block on one end of which an annular depression is turned to engage the mouth of the flask to be used. Gaskets of tin-foil can be employed if necessary. The block is held in place by means of springs stretched between it and a brass collar around the neck of the flask. The inner tube of the condenser passes through a hole in this block, the connection being made by soldering with tin.

Determination of the specific gravities of minimal amounts of materials by the immiscible balance: WILLIAM G. EXTON. It is often necessary (blood and other body fluids, scums, dust, etc.) or expedient (viscosity, expense of materials, etc.) to determine the specific gravity of minimal amounts of liquids or solids, and this may be done rapidly and conveniently with the immiscible balance. The material to be tested is suspended in equilibrium in a mixture of two solutions (light and heavy) which are miscible with each other but not with the sample, *i. e.*, petroleum ether-carbon tetrachloride, benzol-chloroform, alcohol-water, brine-water and other combinations are suitable. The apparatus consists of a cylindrical mixing chamber having for its floor a stopcock of special design which connects with a thistle tube and a spout. With the cylinder partly filled, a drop or a fragment of the material to be tested is immersed, and the specific gravity of the mixture is then varied at will without agitation of any kind by dropping the heavier component in from above or forcing the lighter component into the cylinder from below until the mixture has the same specific gravity as the material to be tested. The specific gravity of the mixture is then determined by Westphal balance or by a hydrometer of special design. The design of the stopcock permits the separated discharge of mixing chamber and thistle tube into their respective containers so that the solutions may be used repeatedly or determinations made in series without discharging the contents by removing the material. The method is delicate, has a wide margin of safety from error and the attainable accuracy seems limited to the accuracy of the method used to obtain the specific gravity of the mixture.

A new method for the control of thermostats: D. J. and J. J. Beaver. A method for accurately controlling the temperature of a thermostat for long periods is described in which a very small current, of the order of 10-5 amperes, is amplified by a vacuum tube sufficiently to actuate a magnetic relay. The circuit is so designed that the chattering of the relay can be prevented by electrical methods. The effect of an oscillating point is obtained without an elaborate mechanism and the back-lash at the mercury contact surface is prevented by the use of iron wire for the contact point. A sensitive thermoregulator is described which is made of monel metal tubing filled with mercury. A simple method of connecting glass to metal is described.

Adiabatic calorimetry at high temperatures: J. W. Williams and Farrington Daniels. Adiabatic calorimetry is possible at high temperatures if sufficient precautions are taken to prevent thermal leakage from the inner calorimeter to the room. The construction of such a calorimeter is described. The outer bath, a glycerine solution of ferric chlorids, is heated electrolytically. Thermal leakage along the resistance thermometer is difficult to overcome, so it is placed in the outer bath, and readings are taken when its temperature is identical with that of the inner calorimeter as shown by zero reading on a sensitive thermocouple. The specific heats of aniline and nitrobenzene in the neighborhood of 100° have been determined.

Black phosphorus: Claude Haines Hall, Jr. The author has collected and analyzed the somewhat extensive and complicated literature relating to black phosphorus. He has shown that in reality two distinct substances have been given this name. The first, discovered by Thenard in 1812, is not a true allotropic modification but is a colloidal suspension while the second, discovered by Bridgman in 1914, is a true modification. He has devised an apparatus to extend Svedberg's method of preparing colloidal suspensions to phosphorus and has definitely prepared suspensions of copper phosphide and mercury in phosphorus. The properties of these suspensions are described.

Notes on potassium chlorate: H. W. Moseley. In this paper the following matters are presented: first, the preparation of specimens of potassium chlorate by altogether different and independent methods; second, the details of the determination of the melting point of the several specimens with check results (the literature shows a variation of 40° in this constant), the composition of the bath necessary for this measurement, and the fact of no decomposition at the melting point; third, the determination of the temperature of beginning decomposition with a study of the decomposition reaction up to and including 500° C.

Ozone: electrical preparation and analysis: A. Silverman and Paul C. Saunders. Ozonizing unit employed for the generation of ozone is a modificatiion of the Berthelot apparatus. The oxygen generator, purifying train, ozonizer, manometer and analyzer are all parts of a single piece of apparatus. All connections are of glass. The parts of the unit are so constructed that all readings can be made in a thermostat. Within the limits of operation employed only O_3 was obtained. Yields have been calculated on the basis of energy consumption. Concordant results have been obtained under given sets of conditions. Drawings accompany the article and lantern slides will be employed in its presentation.

The analysis of gaseous mixtures of nitrogen peroxide, nitric oxide, nitrous oxide and nitrogen: Lowell H. Milligan and C. Herbert Quick. The gases are conveyed by pure CO_2 through an absorption train which removes NO_2 and NO, and then through NaOH soln, which takes out the CO_2 and over the surface of which the N_2O and N_2 collect. The N_2O is determined by slow-combustion with hydrogen and the N_2 is obtained by difference. In the absorption train conc. H_2SO_4 is used to absorb NO_2, and part of the NO if the latter is present with NO_2. The total nitrogen and the nitrous nitrogen in the acid are afterward determined, and from them the NO_2 and NO absorbed are calculated. A definite volume of std. permanganate soln., acidified with H_3PO_4, is used to absorb the rest of the NO, and afterward the excess permanganate is determined. The total NO originally present is the sum of that absorbed in the H_2SO_4 and in the permanganate soln. The method was tried on known quantities of the gases, and was found satisfactory.

The action of hydrogen peroxide on photographic gelatino-silver halide emulsions: S. E. SHEPPARD and E. P. WIGHTMAN. A detailed study of the action of hydrogen peroxide on photographic plates has been made with the idea of obtaining more complete data on the subject in order to compare the action with that of light in the formation of latent images. Both the intensity (concentration) and time factors were considered as well as development conditions. As a side problem it was found necessary to consider also the effect of concentration of the acid (or alkali) content of the hydrogen peroxide. The effects are in many ways quite similar to the action of light. Other conclusions can not be drawn until further work has been completed. We have proposed the tentative hypothesis that silver nuclei in the silver-halide grains serve as catalytic agents for the decomposition of hydrogen peroxide which is chemi-luminescent.

Reactions at boundaries of phases; the problem of promoter action and the theory of the latent photographic image: HUGH S. TAYLOR. From a literature study and from investigations it has been established that the boundaries of two phases constitute a most reactive portion of a heterogeneous system. Evidence is available to show that a number of cases of promoter action can be attributed to enhanced reactivity of mixed catalysts at interfaces between the components of the catalyst mixture. The analogy between the development of the latent photographic image and the reduction of metallic oxides by various reducing gases at low temperatures can be established. Studies of the latter are very suggestive as to the necessary extent of nuclei production precedent to the production of a developed image in the individual grain of the photographic emulsion.

Hydrogen ion catalysis in lactone formation: H. W. CLOSE and HUGH S. TAYLOR. A study of the catalytic conversion of hydroxy-acids to lactones, using acids as catalysts, has been made. The influence of variation of the catalyzing of acid and of its concentration, of added neutral salts and of their concentration, of temperature and of the solvent, have been made the object of investigation. It has been shown that it is probably the non-hydrated hydrogen ion which is the active catalytic agent. The remarkable results which this leads to, when ether is used as solvent, have been outlined and experimentally verified.

The hydrogen ion concentration of buffer solutions at elevated temperatures: ROBERT E. WILSON. Despite its importance from a number of aspects, there is practically no data in the literature as to the hydrogen ion content of the various recognized "buffer" solutions at temperatures above 40° Centigrade. Since the p_H of neutral water and of ordinary solutions of alkalies drops off markedly with increasing temperature, on account of the increased ionization constant of water, it was especially desired to determine how the alkaline buffer solutions behaved in this respect. Measurements have been made on various borate, phosphate and phthalate solutions and indicate that the change in p_H between 30° to 90° (calculated on the assumption that the p_H of 0.1 N HCl is constant) is very small, compared with that of ordinary alkaline solutions. This is, of course, due to the fact that all owe their buffer action to the ionization of *acid* salts of some polyvalent acid. A phosphate buffer solution has been prepared which is *acid* at 30° and *alkaline* at 90°, although its p_H remains constant. Most indicators behave much like the buffer solutions, and hence a given color may indicate acidity at low temperatures and alkalinity at higher temperatures. The paper presents the results in graphical form.

Tracks of alpha particles in gases: R. W. RYAN and W. D. HARKINS.

The ferrocyanide test for zinc: R. D. MULLINIX and A. L. STALLBAUMER. Potassium ferrocyanide precipitates a white zinc ferrocyanide which, when treated with bromine water, turns a characteristic yellow color. No systematic work has been done to determine the best conditions for the test or to compare its sensitiveness with that of the hydrogen sulfide test. Such work has been done by the authors and leads to the following conclusions: (1) $K_4Fe(Cn)_6$ test for zinc is ten times as delicate as the H_2S test. 0.1 mg. of zinc ion in 50 c.c. of solution can be detected, 1.0 mg. is about the limit for the sulfide method. (2) The test should be carried out in a solution about one half normal with acetic acid and should contain ammonium salts. Warming to 60 aids flocculation. (3) The ferrocyanides of the alkaline earth metals are too soluble to interfere, other metal ions must be removed. (4) The yellow color with bromine water is also given by cadmium ferrocyanide.

Qualitative analysis without hydrogen sulfide: R. D. MULLINIX. G. Almkvist has proposed a method without the use of H_2S, but Na_2S followed by H_2SO_4. (*Zeit. anor. Chem.*, 103, 221-242, 1918). I have used for the past two years with qualitative classes a method in which, after the removal of the silver group by HCl, a mixture of NaOH, Na_2CO_3 and bromine water precipitates a group of hydroxides and carbonates, which are then further separated. The As, Sb, Sn, Pb traces, An, Al and Cr are in the filtrate. This is divided by HCl followed by NH_4OH, and zinc tested for in the presence of chromate and arsenate by the potassium ferrocyanide method. This is a preliminary communication and will be followed by more detailed work on the group analyses and end tests.

DIVISION OF SUGAR CHEMISTRY

S. J. Osborn, *chairman*
Frederick Bates, *secretary*

Detection of sugar in condensed waters by means of cresol: G. E. STEVENS. Fifteen ml. of cresol (U. S. P. Merck) is dissolved in a castile soap solution (6 gms. soap in 100 c.c. of distilled water). The mixture is warmed until a complete solution is obtained. This solution can be made up in litre quantities in the above proportions without deterioration. Approximately one inch of water to be examined is placed in a 6 inch by ⅝ inch test tube and five to ten drops of the cresol solution is added and then thoroughly mixed. Cool if the water is hot and then add concentrated sulfuric acid from a dispensing burette, holding the tube in an inclined position so that the acid will run down to the bottom and form a separate layer, and continue to add the acid until the acid layer is ¾ inch deep. The tube is then rolled between the palms of the hands and if sugar is present a reddish black to pink color ring will develop, the color depending upon the concentration of sugar in solution. A white translucent screen is recommended, to be placed between the eye and the source of light, such that the color reaction will be more easily recognized, especially in solutions containing very faint traces of sugar.

Hydrogen-ion determination as a method of refinery control. Preliminary report: H. Z. E. PERKINS. Direct control of acidity and alkalinity in sugar refining is obtained only at certain points, chiefly at beginning. After washing, sugar goes through main process of clarification, bone-black decolorization and crystallization without material change in ionization. By-products are unstable in composition, ferment quickly and are moreover treated with defecating agents, acid and alkaline. Ionization is variable, being resultant of several factors, natural and artificial. Main products, highly crystallizable, light in color, are easily tested with color indicators, but appear sluggish and uncertain with potentiometer. Lower products, dark colored, can not be used in color reactions, but respond better to electrometric tests. Figures are given showing variations and stability.

A study of the formation of gum levan from sucrose: W. L. OWEN. The formation of gum levan from sucrose by bacteria is not, as has been claimed by previous investigators, dependent upon its inversion and the utilization of invert sugar while in the nascent condition. Experiments on the production of gum levan in the presence of added invertase show that under these conditions it is decreased to the extent to which the invertase is active. The decrease is always greatest where the conditions are most favorable for invertase action. The optimum p_H for gum production is between 6.7 and 7.0, but the fermentation can proceed slowly where the p_H is 9.5. Under the latter conditions the addition of invertase does not reduce the production of levan by the bacteria.

The invertase value of the clerget constant: R. F. JACKSON.

A simple check valve: J. F. BREWSTER. A check valve for use with the water vacuum pump to prevent sucking back is made by cutting part way through a solid rubber stopper at the narrow end, leaving a thin flap or disk. The stopper is then bored to receive a piece of glass tubing, the flap being left intact. The valve stopper is inserted in a short length of glass tubing wide enough to allow free play of the valve. By means of a second one-hole stopper, glass and rubber tubing the valve is connected between the pump and the apparatus to be evacuated.

Some notes on activated vegetable chars: C. E. COATES. This article gives some data relative to the preparation and analysis of vegetable chars from various sources. There are also given some tentative conclusions as to some of the underlying principles in the preparation of decolorizing chars.

The influence of borax on the polarizing power of mannitol: C. A. BROWNE.

The contraction in volume of sucrose solutions upon inversion: R. F. JACKSON.

The Vallez rotary filter press: W. D. HORNE. This newly introduced filter press differs from the preceding types of leaf presses in having its filtering discs set upon a hollow horizontal shaft which revolves slowly during filtration, insuring uniformity of deposit of cake upon the leaves. Paper pulp is used as the filtering medium, which gives greatly increased speed of filtration, while the uniformity of the cake allows of sweetening off with the minimum amount of water and gives a very low sucrose content in the washed cake. The washing out is particularly effective, and the arrangement of parts allows of very rapid discharging, cleansing and refilling.

Comparative color determinations in cane sirups and molasses: F. W. ZERBAN and S. BYALL. The object of this investigation was to ascertain whether it was possible with the Hess-Ives tint photometer to detect any difference in the specific transmissive index of cane products when the sample was in one instance dissolved in water and filtered with a small amount of kieselguhr, as previously practiced by the authors, and in the other diluted with white sugar sirup and filtered according to Peters' and Phelps' method. It was found, with twelve cane products representing the entire color range, that water dilution gave too low figures in 70 per cent. of the determinations, and too high figures in the remainder; the average difference was surprisingly small, —0.78 per cent. of the color for the red glass, —2.13 per cent. for the green glass and —6.28 per cent. for the blue glass. Only in a few individual determinations did the error due to water dilution exceed to any extent that attributable to the permissible error in the readings themselves. With the Hess-Ives instrument, therefore, the method previously used by the authors is sufficiently exact for practical factory purposes. Conditions are, of course, different when the spectrophotometer is used.

The countercurrent application of kelpchar in the decolorization of sugar and syrup: J. W. TURRENTINE. A process is described for the continuous, automatic and countercurrent application of kelpchar in the decolorization of sugar and other solutions and liquids. Use is made of the best filter practice, the process admitting of the employment of the most adaptable of modern filters. Thus vacuum or pressure filters or centrifugals may be employed, depending on the nature of the liquid to be filtered. The kelpchar by this process is admitted at one end of the apparatus, is applied countercurrent-wise to the liquid undergoing decolorization in as many applications as desired, and is discharged as spent cake; while the crude liquid is admitted at the end of the apparatus at which the spent cake is discharged and is delivered in a completely purified state at the other, upon entering the apparatus coming into contact with the practically spent carbon and finally before emerging undergoing treatment with the fresh kelpchar entering. In the one-stage application of a decolorizing carbon, the carbon first loads itself up with those impurities most easily removed, and finally adsorbs those least easily taken up. Thus an excess of the reagent is required, and at that an excess probably out of proportion to the decolorization to be effected. In the present system kelpchar that has been used to adsorb the impurities most difficult to remove is still available with unimpaired power to adsorb the impurities more easily adsorbed. In this way full use is made of the decolorizing properties of the kelpchar and the most efficient application of that material results. The advantages gained are that smaller quantities of kelpchar are in use and require reactivating and losses of values are correspondingly reduced. The process admits of continuous and automatic operation, and labor and laboratory supervision are reduced to a minimum.

Estimation of caramel in sugar products: A criticism of the Ehrlich method: G. P. MEADE. Ehrlich bases his method on the claim that saccharan, a component of caramel, is not precipitated by lead subacetate. The present investigation shows that this is true only with saccharan dissolved in distilled water; if any of the ordinary impurities are present that form a precipitate with lead the saccharan is carried down with the precipitate. Known amounts of saccharan and of caramel, added to molasses solutions, are largely removed by clarification with lead subacetate. Therefore, the Ehrlich method is valueless.

A steam-heated laboratory vacuum pan: J. F. BREWSTER. The body of the vacuum pan consists of an inverted bell jar with open wide neck fitted with a rubber stopper through which pass the leads of the 3/16 or 1/4 inch coil of copper tubing, the feed and drain-off pipes. A second open neck bell jar, or better, the dome of a porcelain vacuum evaporating apparatus fitted to the body with a rubber gasket forms the top of the pan. Through the upper rubber stopper passes the connection to the condenser. The apparatus is very efficient and may be used for all sorts of evaporations under diminished pressure.

CHARLES L. PARSONS,
Secretary

THE AMERICAN MATHEMATICAL SOCIETY

THE two hundred and twenty-fourth regular meeting of the American Mathematical Society was held at Columbia University, New York City, extending through the usual morning and afternoon sessions. The attendance included forty-eight members of the society. The secretary announced the election of twenty-one persons to membership in the society; twenty-two applications for membership were received.

At the meeting of the Council, a list of nominations for officers and other members of the Council was presented by the Committee on nominations, and was unanimously accepted. Ex-Secretary F. N. Cole, who has served twenty-five years as secretary of the society, was nominated for the presidency. Secretary Richardson reported that Professor Cole, while appreciating the honor done him by the nomination, found himself unable, on account of the condition of his health, to accept. The Council with regret accepted his decision, and adopted an alternative nomination presented by the committee. The following resolution was adopted:

> We, the Council of the American Mathematical Society, desire to place on record an expression of our profound regret that Professor Cole feels compelled because of ill health to decline the nomination to the presidency of the Society. We believe that the members of the Society in general will share our disappointment that the opportunity is thus denied us to confer on Professor Cole the honor which would most suitably express our high esteem of him and of his signal services to the Society.

The Committee on the Cole Fund presented a report recommending that the fund be used to endow a prize to be called the Frank Nelson Cole Price in Algebra. The recommendations, which appear elsewhere in SCIENCE, were accepted by the Council.

The following papers were read at this meeting:

Parallels and geodesics in Weyl's affine geometry: EDWARD KASNER.

Einstein's equations of the second and third kinds: EDWARD KASNER.

Projective and affine geometry of paths: OSWALD VEBLEN.

Theorems on irreducible continua: G. A. PFEIFFER.

On the mapping of dyadic sets: G. A. PFEIFFER.

On the analysis situs of the plane when the (directed) line is taken as element: JESSE DOUGLAS.

Note on the integral of mean curvature over a surface: JESSE DOUGLAS.

Note on quartiles and allied measures: DUNHAM JACKSON.

Particle geometry: B. Z. LINFIELD.

On certain polar curves with applications to the location of the zeros of the pth derivative of a rational function: B. Z. LINFIELD.

On the expression of the sum of any two determinants as a determinant of more dimensions: L. H. RICE.

A Pythagorean functional equation: EINAR HILLE.

A class of functional equations. Preliminary communication: EINAR HILLE.

Oscillation theorems in the complex domain: EINAR HILLE.

Note on the internal evidence of the reliability of a test: W. L. CRUM.

The use of the median in determining indices of seasonal variation: W. L. CRUM.

A general construction for circular cubics: R. M. MATHEWS.

A theorem on conics, with applications: R. M. MATHEWS.

A property of the characteristic elements of a group: LOUIS WEISNER.

Visual intuition in Lobachevsky space: E. L. POST.

Note on a generalization of the old puzzle of 8, 5 and 3 pint vessels: ELIZABETH B. COWLEY.

The Annual Meeting of the Society will be held at Harvard University December 27-28, 1922, in connection with the meeting of the American Association for the Advancement of Science.

R. G. D. RICHARDSON,
Secretary