Lycopsida
  Order 1. Lycopodiales
    2. Equisetales
Pteropsida
  Class 1. Aspermæ (Ferns)
    2. Gymnospermæ
    3. Angiospermæ
   Subclass 1. Dicotyledoneæ
    Division 1. Archichlamydeæ
     Order 1. Casuarinales
      Family 1. Casuarinaceæ

. . . .

    Division 2. Metachlamydeæ
   Subclass 2. Monocotyledoneæ
     Order 41. Pandanales

. . . .

      51. Orchidales
      Family 284. Orchidaceæ

HENRY S. CONARD

GRINNELL, IOWA,
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(*Continued*)

Studies in fluoride equilibria: I. Calcium borofluoride: A. F. O. GERMANN and GILBERTA TORREY. Moissan, in his work with boron trifluoride, passed the gas through a tube containing heated calcium fluoride, presumably to free the gas from any hydrogen fluoride that might contaminate it. Calcium borofluoride, $Ca(BF_4)_2$ is described in the literature, and it seemed reasonable to expect the formation of a similar compound under the conditions of Moissan's work. To determine this, weighed samples of calcium fluoride were heated for several days at a temperature of 200° C. in an atmosphere of pure boron trifluoride under a pressure of 430 mm. Absorption took place slowly, and until one half molecule of the gas was absorbed. Blanks were run to determine the amount of absorption by the glass, etc., of the reaction tube; this absorption was found to be slight. The compound, $2CaF_2.BF_3$, forms by direct union of the constituent molecules under the conditions outlined.

Chromatic emulsions: HARRY N. HOLMES and DONALD H. CAMERON. A "solution" of ordinary cellulose nitrate (11 per cent. nitrogen) may be somewhat diluted with benzene and then emulsified with glycerol. A creamy white emulsion of drops of glycerol in the other liquid results. With addition of enough benzene the indices of refraction of the two liquids may be made equal, thus securing a transparent emulsion. With the right amount of benzene a very beautiful yellow emulsion which is a soft blue by transmitted light is produced. The next step up in the "color chromatic scale" is a pink emulsion which transmits green light. Next a lavendar emulsion is made transmitting yellow light. With still more benzene a blue-green emulsion is secured with a sunset red glow by transmitted light. The colors are explained by the great difference in dispersive power of the two liquid phases, transparency being fundamentally necessary to let the light through.

Cellulose nitrate as an emulsifying agent: HARRY N. HOLMES and DON H. CAMERON. By the use of cellulose nitrate as an emulsifying agent emulsions of the "water-in-oil" type may be prepared. Cellulose esters containing about 11 per cent. nitrogen are most suitable. "Water-in-oil" emulsions are far less stable than the more usual "oil-in-water" type. To prepare the former such emulsifying agents as calcium and magnesium soaps, lanolin, carbon and rosin have been used. However, cellulose nitrate is far superior to these agents in the stability of the emulsions produced by its aid. For example, if water be shaken with a suspension of cellulose nitrate in amyl acetate (2 per cent. is suitable) a good white emulsion of drops of water dispersed in amyl acetate is obtained. Instead of amyl acetate any liquid that peptizes ("dissolves") the cellulose ester may be used provided also the two liquids are immiscible. One of the important factors in the formation of this emulsion is the formation of a tangible film around each drop. With a very large drop the film may be observed under suitable conditions. It is probably formed by great adsorption, to the point of coagulation of the cellulose nitrate at the liquid interface.

A theory of the photographic latent image: HARRIS D. HINELINE. The suggested theory concerns itself with the latent image as distinct from the photo-electric effect on the silver halide, and as distinct from the print out image. A reaction between the dissociation products of the silver halide and gelatine which will yield energy enough to account for the energy discrepancy pointed out by other workers, is suggested. In terms of this theory the latent image then consists of a combination between the bromine and substituted ammonia of the gelatine and the silver and amido acid, the amido acid compound being much more easily reducible than the bromine compound of silver. This theory can account for the failure of the reciprocity law, for the shape of the H and D curve, for the phenomenon of reversal, and states the distinction between the latent image and the print-out image. The energy relationships are such as to indicate the formation of a considerable proportion of silver amido acid compound, which then becomes the material affected by the developer.

The interaction of platinum hydrogen acid and hydrogen peroxide: S. A. BRALEY and O. V. SHAFFER. Following the work of Rudnick in 1917 a study of the preparation of H_2PtCl_6 was made. It was found that commercial 3 per cent. H_2O_2 acted only very slowly on ignited platinum black, and on platinum sponge did not give H_2PtCl_6 suitable for accurate analytical work. By concentrating to about 30 per cent. and redistilling from quartz to quartz H_2O_2 was prepared which would give acid with a KCl factor of .3045 and suitable for accurate KCl determinations.

Is there a sharp transition point between the gel and sol? EUGENE C. BINGHAM. The viscometer gives a satisfactory method for distinguishing sharply between a liquid and a solid. Under the influence of a small shearing stress a liquid is continuously deformed, whereas a solid is not. The fluidities of a 10 per cent. gelatine sol in glycerol-water mixture of 1.175 sp. gr. calculated from the data of Arisz follow the equation

$$\phi = 0.000227 \ (t - 45.2)$$

very closely. This indicates that the fluidity would reach the zero value when the temperature becomes 45.2° C. At this point the substance would become a solid and there would appear to be a sharp transition point between the two states.

The validity of the additive fluidity formula: EUGENE C. BINGHAM and DELBERT F. BROWN. It is shown that in many mixtures of inert liquids there is a contraction of liquid in mixing. If this contraction is multiplied by a constant, which is usually about 2,000, one obtains the amount by which the observed fluidity differs from the value calculated on the additive formula. It is evident from the above that even in the case of so-called inert liquids there is an adjustment of the free volume, for which several equations have been proposed. These give as good agreement as can be expected with the data available.

The emulsion colloids as plastic substances: EUGENE C. BINGHAM and WILLIAM L. HYDEN. The fluidity-volume concentration curves of suspension colloids were found to be linear by Bingham and Durham, and the zero of fluidity served to demarcate between the viscous liquid and plastic solid. Nitrocellulose solutions in acetone present a new case, differing from all others studied up to the present. The fluidity of even very dilute solutions is not a constant but a function of the pressure. The solutions, therefore, act as plastic solids even in very dilute solutions. It is found to be convenient to measure the plasticity of such solutions in the viscometer. This has heretofore always been done on the plastometer.

The properties of cutting fluids: EUGENE C. BINGHAM. In cutting metals, fluids are often used, sometimes to lower the temperature, often to lubricate the surfaces between the tool and the chip. But whereas lubrication under the best conditions is merely a matter of viscosity, two oils of the same viscosity may have the most extraordinary difference in efficiency. The cutting oil *par excellence* is lard oil and it derives its superiority from its high *adhesion.* Mineral oils may have their lubricating efficiency raised by the addition of substances having high adhesion.

The diffusion of hydrogen through silica glass: JOHN B. FERGUSON and G. A. WILLIAMS. The results of a redetermination of the rates at which hydrogen will pass through silica glass at temperatures between 440° and 727° C., and at pressures between 0.5 and 1 atmosphere are herein presented. The fact that helium will pass through silica glass at a much faster rate than does hydrogen has been confirmed.

The atomic weight of nitrogen by the thermal decomposition of silver trinitride: HAROLD S. BOOTH. In this determination silver trinitride was slowly decomposed by heat in a suitable all-glass apparatus into silver and nitrogen, the evolved nitrogen passed through phosphorus pentoxide to absorb the traces of moisture retained in the interstices of the silver trinitride, and the nitrogen adsorbed in a charcoal tube immersed in liquid air. The method as planned involved no corrections except for errors in the weights. Every precaution was taken to insure the purity of the materials and the accuracy of the method. The average of fourteen determinations of the ratio 3N : Ag gave 14.007 for the atomic weight of nitrogen.

Studies in adsorption from solution: W. A. PATRICK and D. C. JONES. A study of adsorption in the capillaries of silica gelatine of a large number of two component systems has been partially completed. A range of liquids from water up to the high petroleums has been investigated. The results have been examined in the light of existing theories. Qualitatively they appear in agreement with the Gibbs relation, those substances being adsorbed that lower the interfacial tension. Qualitatively they can not be represented at all by the Freundlich equation. A theory is advanced that solubility and the effects of the enormous curved surfaces present in the capillary pores are the determining factor.

Summary of study of system ammonia-water: W. A. Patrick and B. S. Neuhausen. (1) A static method has been developed for measuring the partial pressure of a component which is relatively very small compared to the partial pressure of the second component. (2) This method has been used to determine the partial pressures of water and ammonia of concentrated ammonia solutions at 0° C., 20° C., and 40° C., at partial pressures of ammonia varying from 1,000 to 4,000 mm. The partial pressures of the ammonia were measured to within 4 to 2 millimeters; and those of the water to 0.08 millimeter. (3) The solubility of ammonia in water was determined at 0° C., 20° C., and 40° C., at pressures from 750 to 3,600 mm. The densities of these solutions were also determined. (4) A theory of the nature of solution of gases in liquids first advanced by Graham has been amplified, and solutions of various gases in liquids classified on the basis of some of the physical and chemical properties of the gas. (5) The formula

$$V = K\left(\frac{P6}{Po}\right)\frac{1}{n}$$

has been found to represent well the solubility of ammonia in water at varied temperatures and pressures. In this formula V is the volume occupied by the liquefied gas dissolved per gram of water; p is the vapor tension and 6 the surface tension of the liquefied gas at the temperature while p is the equilibrium gas pressure. The constant k for ammonia has the value 0.49 and $1/n$ has the value 0.69.

Heat of wetting of silica gelatine: W. A. Patrick and R. C. Grimm. The amount of heat liberated when silica gelatine is wetted by a number of liquids has been accurately measured in an adiabatic calorimeter. The results have been examined from the standpoint of the surface energies involved. On the assumption that silica gelatine presents a surface that is essentially water, all of the experimental results were capable of being brought into agreement with the idea that the heat of wetting is essentially a manifestation of changes of surface energy. The heat of wetting of water between 0° and 4° was found to be positive and greater than that at 20°.

Adsorption by precipitates. IV. Acclimatization: Harry B. Weiser. The amount of electrolyte required to coagulate a colloid is influenced by the rate of addition. Since the quantity of electrolyte that will cause complete coagulation when the addition is rapid will not cause complete coagulation when the addition is slow, the colloid is said to become acclimatized and the phenomenon is called ''acclimatization.'' This term is a misnomer. The dropwise addition of an electrolyte throughout a prolonged period is accompanied by fractional precipitation of the colloid. The excess electrolyte required to precipitate a colloid by the slow process is due to removal of precipitating ions by adsorption of the neutral particles during fractional precipitation. The factors which determine the excess electrolyte required for a given slow rate of addition are: (1) the extent to which the colloid undergoes fractional precipitation; (2) the adsorbing power of the precipitated colloid; and (3) the adsorbability of the precipitating ion.

The oxidation and luminescence of phosphorus. III. The catalytic action of vapors: Harry B. Weiser and Allen Garrison. Phosphorus trioxide is an intermediate product in the complete oxidation of phosphorus. The luminescence of phosphorus is due to the oxidation of this lower oxide. Certain vapors inhibit the oxidation of phosphorus and others accelerate the oxidation. Such substances are designated as catalysts, but they are not catalysts in the ordinary sense in which this term is used. The vapors are condensed or adsorbed on the charged or uncharged oxidation products of phosphorus (P_4O_6 and P_2O_5). If the vapors react with phosphorus trioxide they increase the rate of oxidation. If they are inert, they prevent further oxidation of phosphorus trioxide and also form a cloud near the surface of the phosphorus. This cloud approaches nearer and nearer the surface as the oxidation becomes less energetic and in certain cases may form a protecting film that stops the oxidation entirely.

Critical solution temperatures as criteria of liquid purity: D. C. Jones. (By title.)

Charles L. Parsons,
Secretary