rest conformed to the general rule. If the data relating to all the mixed colonies of *Partula suturalis* are assembled, the summary is as follows: Cases where two or more young are *like* the parent, 1,133; cases where two or more young are *unlike* the parent, 184. There are, therefore, 1,317 instances in the *suturalis* material in which the rule is observed. If the facts are brought together for all the colonies of Tahitian and Moorean species in which dextral and sinistral snails occur, the number of conformable instances amounts to more than 3,000. In sharp contrast with all these, there are only five observed cases of mixed broods in Partula, and these have been found in only one species, in a single locality.

Sturtevant's proposed explanation of the hereditary mechanism in the cases where the rule is followed is both plausible and attractive. The exceptional occurrence of mixed broods in Limnaea and Partula would indicate that the hereditary procedure postulated by Sturtevant is not invariable, and that there are unusual circumstances under which additional factors may operate so as to produce other than the expected results.

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The oriented wedge theory of emulsions: distribution of sizes in emulsions produced by oleate soaps: WILLIAM D. HARKINS and ERNEST B. KEITH. In an earlier paper (1917) it was indicated that the shape of the soap molecules in the interface between water and oil is an important factor in the determination of the sizes of the drops in emulsions and also of the type of emulsion as oil dispersed in water, or water dispersed in oil. Finkle, Draper and Hildebrand determined the distribution of sizes for benzol dispersed by sodium, potassium and caesium palmitate as 5.0, 3.7 and 2.5 microns, respectively, at the peaks which represent the greatest number of drops of a certain size. We find: (1) The size of the drops of the emulsions is highly dependent upon the nature of the oil which is dispersed. Thus the peak for the greatest number of drops for sodium oleate as an emulsifying agent comes at 1.94 microns in benzol and mesitylene, 3.9 microns in octane and 9.2 microns in stanolax. (2) The peaks lie on an equilateral hyperbola. In octane the sizes for lithium, sodium, potassium and caesium oleates are: 4.7, 3.9, 2.9 and 1.95 microns at the respective peaks. In stanolax the sizes for sodium, potassium and caesium oleates are: 9.2, 6.9 and 4.6 microns. (3) Bases, salts and oleic acid produce marked changes in the size. Their effect is to greatly reduce the size of the drops. (4) The oil drops are negatively charged. The potential difference between the oil drops and the water is 60 millivolts for a sodium oleate and nearly the same for a caesium oleate emulsion of octane. The addition of sodium hydroxide greatly reduces this P. D. Various other relations of emulsions will be presented.

Interfacial tension in systems of importance in connection with emulsification: WILLIAM D. HARKINS and W. A. THOMAS. Bancroft and Clowes have shown that salts produce marked effects upon the interfacial tension between water and oil when a soap is adsorbed at the interface. Clowes' results are expressed as the number of drops formed from a certain pipette, and can not be transformed into surface energy values. The writers have carried out measurements by the use of water 0.001 molar with respect to sodium hydroxide, which was dropped into purified stanolax which was 0.001 molar with respect to oleic acid. The interfacial tension was found to be 7.2 dynes per cm at 20°, while when pure water is dropped into pure oil the value is 31.05. When the solution of the base is made 0.15 molar with respect to sodium chloride the interfacial tension is reduced to 0.00 dynes per cm, or a value too small to be measured with the apparatus then available. With olive oil the corresponding value was 0.023. With 0.001 M. sodium hydroxide and 0.0015 M. calcium chloride the surface tension is increased to 9.65, while when both sodium and calcium chlorides are present with respective concentrations 0.15 M. and 0.0015 M. the value is 7.48. This value keeps nearly constant if the two salts are increased in concentration, but with the ratio of the concentrations kept at 100 to 1. As has been pointed out, sea urchins will live in salt solutions in which the ratio of sodium to calcium chloride is 80 to 1, but not in water in which only one of these salts is present.

Plasticity and melting points: EUGENE C. BINGHAM, L. T. BROWNMILLER and NORMAN WIGGINS. The melting point of a substance often depends upon the flow of the material. There are three softening temperatures to be distinguished and the solidifying point is often quite different from the melting point. The measurement of the plasticity of materials through the softening range makes possible more precise measurements of the transition temperatures than heretofore.

Plasticity and solubility: EUGENE C. BINGHAM and J. K. ROSS. When a colloid is described as being more soluble in one solvent than in some other, the difference depends upon the flow of the materials. It is suggested that the yield value may be a measure of insolubility. As the temperature is raised the solubility becomes infinite. Is the solution a "true solution"?

Suspensions vs. emulsion colloids: EUGENE C. BINGHAM and C. RAYMOND HOOD. Polar and non-polar colloids are quite sharply distinguished by means of the plastometer. The yield value in suspensions has been found to be independent of the dimensions of the plastometer but this is not true of polar colloids. This latter peculiarity has not before been noted.

Viscous liquids for viscometer calibration: EUGENE C. BINGHAM and H. R. ARNOLD. There is need for pure substances which do not absorb water or otherwise change in fluidity, whose fluidity is about that of linseed oil. The authors have studied several substances of this type. Butyl tartrate is an example whose fluidity is 0.344 at 5° and 1.16 at 20° C.

The effect of hydrophilic colloids on size and distribution of particles in electrolytic precipitation. II. Gelatin and basic lead carbonate: influence of temperature: DORMAN MCBURNEY and WESLEY G. FRANCE. In an earlier paper it was shown that the presence of gelatin over a concentration range of 0 per cent. to 1 per cent. decreases the average size, and increases the uniformity of the particles of basic lead carbonate, electrolytically precipitated at 20° C. In the present work the effect of gelatin on the particle size and uniformity of the precipitate has been investigated over a temperature range of 5.0° to 50.0° C., and a similar effect, but of different magnitude, observed for each temperature. However, the maximum sized particles were found at 20°, while above or below this temperature, the average particle sizes were smaller and the uniformity greater.

Platinized alundum cathodes in electro-analysis: T. S. ECKERT and WESLEY G. FRANCE. The suitability of platinized alundum as a substitute for platinum gauze in electro-analysis has been studied. The conclusion reached after an investigation of the factors involved in the electro-deposition of copper is that cathodes of platinized alundum are unsatisfactory for the following reasons: (1) The weight of the cathodes was not constant; (2) the circulation of the electrolyte was too slow; (3) due to adsorption extreme precautions in washing, drying and weighing were required; (4) the metal deposit oxidized rapidly.

A new apparatus for the measurement of transference numbers by moving boundaries: THOS. B. BRIGHTON. This apparatus is devised to simplify measurements by the moving boundary method. The boundaries between solutions are made by a device which slides the indicator solutions on to the solution to be studied. Boundaries are sharp and measurements are easily made.

Transfer resistance: ALFRED L. FERGUSON and GERRIT VAN ZYL. A set-up is described by means of which measurements may be made by both the direct and the commutator methods at the same time and under identically the same conditions. The commutator is so constructed that the potentials may be measured over the whole period during which the electrodes are being charged or discharged, or over any portion of this period. The belief is expressed that the results indicate there is no such thing as ''transfer resistance,'' and that the conception developed, due to the use of potential values which did not represent the things they were assumed to represent.

The electrometric determination of Ph in the presence of copper salts: VICTOR K. LAMER and PAUL M. HORTON. The presence of minute traces of copper salts is sufficient to interfere seriously with the use of the hydrogen electrode, owing to a poisoning of the electrode by the reduction of cupric ions to metallic copper. The potentials of the benzoquinhydrone electrode system are positive to those of the cupric—cuprous and cupric—metallic copper systems so that reduction of these ions does not occur when this electrode is used in acid solution. Using this electrode it has been possible to obtain potentials, which are comparable with the hydrogen electrode as regards stability and reproducibility over periods of time up to six hours in the presence of saturated copper sulfate. The method has enabled us to study the effect of Ph on the adsorption of cupric ions by charcoals of different preparations. The simplicity, accuracy and speed with which Ph determinations can be made with the quinhydrone electrode recommend its use in other cases where poisoning of the hydrogen electrode is due to the presence of copper or other ions whose electrode potentials are less than 0.6990 volts positive to the hydrogen electrode, and the method should be of value in the control of the acidity of commercial nickel and cobalt plating baths where traces of copper ions are almost invariably present, as well as detecting the presence of free acid in copper sulfate solutions.

Diphenylamine as indicator in the reduction of vanadic acid: N. HOWELL FURMAN. Knop has proposed the use of diphenylamine as indicator in the ferrous iron—bichromate reaction. In this investigation it was found that diphenylamine gave a sharp change—deep blue to residual color of solution—at the completion of the reaction: $VO^{-}_{4} + Fe^{+++} + 6H^{+} \rightarrow VO^{++} + Fe^{+++} + 3H_2O$. The intense blue vanadium color reaction has been previously reported. Diphenylamine reduces vanadic acid. A slight correction, empirically determined, must therefore be added to the volume of ferrous sulfate. The correction was 0.07 cc of 0.02 N $FeSO_4$ per 0.2 cc indicator (0.1 g diphenylamine in 100 cc concentrated H_2SO_4). A sufficient quantity of phosphoric acid must be present to mask the color of the ferric iron. Accurate vanadium results were obtained when Fe^{III}, As^{V}, and U^{VI} were present. Bichromate ion or other substances which oxidize iron readily must be absent or determined separately. The method was successfully applied to the determination of chromium and vanadium in analyzed steels (Bureau of Standards Nos. 30b and 50).

A new absorbent for oxygen in gas analysis: LOUIS F. FIESER. An alkaline solution of sodium hydrosulfite containing a small amount (2 per cent.) of anthraquinone-β-sulfonic acid as catalyst completely absorbs the oxygen from a 20.9 per cent. sample on shaking for one minute and from a 90 per cent. sample in two minutes. The reagent, characterized by its low viscosity, is less expensive and more easily handled than pyrogallol, can not evolve carbon monoxide and indicates the point of exhaustion by a color change, maximum speed of absorption being maintained up to this point.

The use of bromate in volumetric analysis. IV. The preparation and properties of normal and basic mercuric bromate: G. FREDERICK SMITH. The preparation of normal and basic mercuric bromates by the interaction of mercuric perchlorate and sodium bromate in acid and in practically neutral solutions is described. The relation of the hydroxy-mercuric bromate to known mercuric salts with complex cations is pointed out. The solubilities of the two bromates in various concentrations of nitric and perchloric acids at 25° are determined. The hydrolysis of normal mercuric bromate with the formation of basic mercuric bromate and free bromic acid in considerable concentration is demonstrated. Basic mercuric bromate is shown to be preferable as a reagent for volumetric bromate reactions.

The analytical separation of rhodium from platinum: EDWARD WICHERS. No adequate method for this separation has hitherto been proposed. The usual procedure of separation by ammonium chloride fails because the precipitation of platinum is incomplete and because the precipitate is always contaminated with rhodium. Rhodium may be separated quantitatively from platinum by hydrolysis in faintly alkaline chloride solutions. Two precipitations are sufficient for ordinary analytical work, and three insure great accuracy. Hydrolysis is effected by adding freshly precipitated barium carbonate and boiling for two to three minutes. Soluble alkalies react with platinum chloride rapidly enough to yield a slightly acid solution on boiling, which prevents the complete precipitation of rhodium. Results are given for mixtures of platinum with 0.1 per cent. to 10 per cent. of rhodium.

The analytical separation of copper from the platinum metals: WM. H. SWANGER and EDWARD WICHERS. In the various methods for the analysis of crude platinum or of platinum alloys, the separation of copper is usually made by leaching with nitric acid the ignited mixture of sulfides of copper and whatever platinum metals were precipitated with it. Data are given to show that nitric acid will not dissolve all the copper from such a mixture, especially if rhodium is present. The familiar precipitation of copper as cuprous thiocyanate will separate it quantitatively from platinum, palladium, iridium and rhodium, if certain conditions, set forth in the paper, are maintained.

The precise determination of the boiling points of oxygen and carbon dioxide, with application to the calibration of platinum resistance thermometers: A. G. LOOMIS and J. E. WALTERS. A careful study has been made of the best conditions to determine the normal boiling point of pure oxygen and the normal sublimation point of carbon dioxide. Especial attention was given to the elimination of errors arising from thermal lag, improper stirring and unsuitable baths. Curves for various conditions are given, together with the probable error for each set of determinations. The precise determination of these points under the best conditions is applied to the calibration of platinum resistance thermometers and a careful check of the Henning method of calibration at low temperatures is given.

A simple cryostat for precise regulation of temperature to —150° C: J. E. WALTERS and A. G. LOOMIS. A cryostat has been developed which employs automatic cooling by means of liquid air. An automatically controlled heater is used to supplement the cooling for finer regulation. The heater may be operated by hand if desired. Rapid stirring of the bath in a large Dewar tube is accompanied by a turbine-type stirrer which contains the cooling and heating elements. By this means lag effects and lateral currents from the stirrer are eliminated. Desired temperatures have been held for considerable periods, with a total variation of not more than 0.01° C.

The accurate quantitative determination of minute amounts of mercury: HAROLD S. BOOTH and NORA E. SCHREIBER. The defects of the various methods at present in use to determine minute amounts of mercury in body fluids are pointed out; chief among these are the errors due to the volatility of mercury salts and to the hydrolysis of dilute water solutions of mercury salts. It is shown that in extremely dilute solutions of mercury salts hydrolysis causes the formation of colloidal mercury compounds. Therefore, any quantitative method which does not provide for the determination of both the colloidal mercury compounds and the ionic mercury will fail to provide an accurate determination of mercury. The authors oxidized the organic compounds present in the body fluids by digestion with potassium permanganate and sulfuric acid. The excess permanganate is reduced by hydrogen peroxide and the latter removed by boiling. Hydrogen sulfide is then bubbled into the clear solution forming mercuric sulfide and the excess hydrogen sulfide is removed by bubbling pure air through the solution. The solution is made almost alkaline by adding 25 per cent. sodium hydroxide solution, and is then well stirred; and then 5 cc of a 1 per cent. sodium hydroxide solution is so added as to float on top. This forms flocculent manganous hydroxide, which acts as a coagulum and enmeshes in it as it settles both the mercuric sulfide and the colloidal mercury compounds. A test of the filtrate showed that less than one part of mercury per billion was left in the solution, which is as near complete precipitation as could be desired. The precipitate is filtered and dried, and then ground up with magnesium oxide and placed in a long ten millimeter tube and sealed at both ends. The tube is heated for three hours at 500° to decompose the mercury which distils over and condenses in the empty cold end. When decomposition is complete the tube is carefully opened and the mercury is collected into one globule with the aid of a glass rod drawn out to a hair, and transferred to a special measuring device which will be described. Tests show that the method is extremely accurate.

Detection of minute traces of mercury. A micro-electro method sensitive to five parts of mercury per billion parts of solution: HAROLD S. BOOTH and NORA E. SCHREIBER. A review of the literature failed to reveal any real study of the sensitivity of the qualitative tests for mercury. A thorough study of the known qualitative tests of mercury and numerous others which occurred to us showed that none had a sensitivity greater than five parts per million and most of them were much less sensitive. Some of these tests had been used to control quantitative methods and were found to be less sensitive than the quantitative accuracy that the investigators were striving for required. The new method we have developed consists briefly of electrolytically depositing the mercury from a drop of the solution to be tested upon a microscopically fine point cathode of copper wire which is then examined under the microscope. About 25 cc of the solution to be tested is evaporated isothermally, the residue moistened with a drop of nitric acid, transferred to a hollowed microscope slide and electrolytically deposited on the microscopic copper point. This deposit under the microscope is a silvery white amalgam turning greenish yellow upon standing. The limit of sensitivity of the method is about five parts per billion. The method is applicable to other metals low in the electromotive series and a study of them is now under way.

A new accurate gas burette—the baro-burette: Harold S. Booth. The chief source of error in attempting to measure gases accurately in an ordinary gas burette is due to the necessity of indirect measurement of the pressure: that is, the operator attempts to obtain the same pressure on the gas in the burette as the pressure of the atmosphere and the latter pressure is then measured separately. In the author's baro-burette the gas burette becomes the well of a barometer and thus the pressure of the gas is measured directly. A vertical glass tube set parallel to the gas burette is connected to the bottom of the gas burette, while just above the stopcock of the burette this parallel tube is offset and expands into a larger tube of the same diameter as the burette. This upper tube is in the same axis as the burette and is the upper limb of the barometer. This upper limb terminates at the top in a capillary tube which is bent over and down so as to lie parallel to the upper limb of the barometer for about 80 cm; the bottom of the capillary tube which is bent up and expanded into a larger tube which in turn is terminated by a stopcock leading to a vacuum pump. A leveling bulb for the mercury is connected by pressure tubing to the bottom of the burette as usual. The method of manipulation of the apparatus will be described with the aid of lantern slides.

The quantitative determination of reduction products of free nitric acid solutions, namely: nitrogen peroxide, nitric oxide, nitrous oxide, nitrogen, nitrous acid, and salts of hydroxylamine, hydrazine and ammonia: Lowell H. Milligan. The development of these analytical methods is part of an investigation now being made at Cornell University, on the action of nitric acid on metals, or more generally, the mechanism of the reduction of nitric acid. Some of the procedures are applications of old methods, others are new. Space does not permit a detailed description of the methods, which will be published soon.

The reduction of free nitric acid by means of ferrous, stannous or titanous salts: Lowell H. Milligan and G. Raymond Gillete. When an excess of dilute HNO_3 is reduced. (1) by Fe^{++} solutions the end products are NO and a smaller amount of NO_2; (2) by Sn^{++} solutions, the primary end-produce is NH_2OH salt, but under many conditions this reacts with the excess HNO_3 forming N_2O together with small amounts of NO, N_2, and traces of NO_2, but no NH_4^+; (3) by Ti^{+++} solutions, the reaction takes place very rapidly forming NO as the chief product together with a considerable amount of N_2O, a smaller amount of N_2 and traces of NO_2 and NH_2OH salt. When the reducing agent is in excess, (1) produces NO; (2) NH_2OH and NH_4^+ salts, and (3) gives practically the same products as when the HNO_3 is in excess. Ti^{+++} salts are stronger reducing agents than corresponding Sn^{++} salts, yet the latter produces a ''more reduced'' product showing that catalytic effects come in which seem to be due to the ''ous'' salt of Ti. In order to explain the results the main reactions are assumed to take place through the stages, $HNO_3 \rightarrow N_2N_2O_5 \rightarrow HNO_2 \rightarrow H_2N_2O_3 \rightarrow H_2N_2O_2 \rightarrow NH_2OH \rightarrow NH_3$. Dehydration of $H_2N_2O_5$ produces NO_2; of $H_2N_2O_3$ produces NO; of $H_2N_2O_2$ produces N_2O. N_2 is produced by interaction of NH_2OH with some preceding stage or stages. The formation of NH_3 may not necessarily take place through NH_2OH.

A convenient potentiometer set-up: Alan Leighton. The paper deals with a system of wiring whereby a Leeds and Northrup, type K, potentiometer is connected through suitably balanced resistances onto the main 220 volt circuit of the laboratory. The usual storage battery which ordinarily supplies power for the potentiometer is then connected across the terminals of the potentiometer. Sufficient current is permitted to pass from the 220 volt circuit not only to maintain the necessary potentiometer voltage, but also to keep a small charging current going into the battery. Since the internal resistance of the battery is insignificant as compared with the resistance of the potentiometer the normal variations of the main power line will be absorbed by the battery, and the voltage at the terminals of the potentiometer will remain constant, to all intents and purposes. The arrangement does away with the inconvenience of charging the storage battery frequently, and overcomes the difficulties encountered when a freshly charged battery is connected into the potentiometer circuit. Sufficient current is passed into the battery to keep it charged at all times, thus insuring that the potentiometer is in working order continuously.

Pure fused uranium: J. W. Marden and H. C. Rentschler. Uranium was prepared by reduction of potassium uranium fluoride with pure magnesium in a high vacuum, high frequency induction furnace. By this new process the metal can be prepared in a pure fused condition without the intermediate steps of washing and handling. Other products of the reaction are distilled away from the metal. Samples are ductile.

The use of perchloric acid in the determination of the cyanogen contents of waste gas liquors: J. P. Simons. The modified Knublench method and Williams' distillation method for the determination of ferrocyanide give unsatisfactory results. Inaccuracy in the former method is due largely to difficulty in obtaining satisfactory end points. With Williams' method results averaged seven tenths of a per cent. low. The successful use of perchloric acid in the determination of silica in silicates and as a substitute in kjeldahl digestions suggested its use in Williams' method instead of sulfuric acid. A number of analyses of highly purified potassium ferrocyanide and of several samples of gas residues gave results which were entirely satisfactory.

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