

Papers which contain photographic evidence that seems conclusive and which leads to the above conclusions have been recently published by the Academy of Science of St. Louis. They give a rational explanation of older phenomena which had not been explained on the two-fluid theory. For example, why are positive and negative Lichtenberg figures so different in form? How are we to explain the arc-like form of discharges, shorter than the critical spark length? What is the critical spark length? An additional suggestion may be made.

Assume two spheres of mass m and m' . They attract each other with a force Kmm'/r^2 . Assume that the spheres are connected by means of a flexible conductor, and that negative corpuscles are pumped out of, or forced into the two masses. A condition will be found for which the attraction between these two masses will be a maximum. If the number of corpuscles in the masses be then either increased or diminished, the attraction will be less. With small masses we can easily reduce the attraction to zero, or make it negative.

Why should we continue to say that in one of these cases we are adding positive electricity to these spheres, when we are all fully convinced that we are not?

The attraction in dynes between these masses of radii R and R' cm., and distant from each other r cm., the matter composing them having a density ρ is

$$A = \frac{RR'}{r^2} (\frac{1}{9}\pi^2\rho^2KRR - V^2).$$

This force will be zero when

$$V = \frac{4}{3}\pi\rho\sqrt{KRR'},$$

where V is potential in electrostatic units. This last condition does not depend upon the distance of these bodies from each other (neglecting mutual induction), but upon the magnitude of the bodies.

For two bodies having the size of the moon and earth, assuming that they have a density $\rho = 5.5$, the potential must be raised to 1.96×10^{17} volts, in order that they shall cease to attract each other.

The last equation may also be written

$$K\rho^2RR' = 9\sigma\sigma',$$

where σ and σ' are surface densities on the two bodies.

The interesting suggestions of Arrhenius in regard to the invasion of our atmosphere by corpuscular radiation, suggest that the actual potential of earth and moon are not widely different. While these considerations are perhaps of no astronomical significance, they nevertheless lead us towards a general conclusion which seems to have some interest.

May we not conclude that Newton's equation for gravitational attraction represents a special case, in which all of the molecules in both masses possess what might be called the normal number of corpuscles?

If one mass is in normal condition and the other is "charged" as above, Newton's equation also represents a special case, the discussion for which is apparent.

FRANCIS E. NIPHER

THE AMERICAN CHEMICAL SOCIETY. IV

DIVISION OF PHYSICAL AND INORGANIC CHEMISTRY

H. P. Talbot, *chairman*

S. L. Bigelow, *secretary*

The Mechanism of Reversible Oxidation and Reduction Reactions in Solutions: E. P. SCHOCH.

Electrolytic Formation of Aniline without a Diaphragm: E. F. FARNAU.

Electrolytic Corrosion of some Metals: G. R. WHITE.

The Vapor Density of Formic Acid as Affected by Changes of Temperature and Pressure: ALAN W. C. MENZIES and PAUL N. LEECH.

The Thermal Expansion of Solid Lithium and its Change of Volume on Fusion: ALAN W. C. MENZIES and R. K. BRODIE.

The Liquidus Surface for the Ternary System Composed of the Nitrates of Potassium, Sodium and Calcium: ALAN W. C. MENZIES and N. N. DUTT.

The Free Energy of Dilution of Hydrochloric Acid: R. C. TOLMAN and A. L. FERGUSON.

A method is described of determining the free energy of dilution of an electrolyte without employing cells that have liquid boundaries. Values of the free energy of dilution of hydrochloric acid

$n/10$ to $n/50$, $n/100$ and $n/500$ solutions are given. The values of the concentration of the ions and undissociated acid as calculated from these measurements are compared with the corresponding values of concentration as calculated from conductivity measurements. The discrepancies between the two methods of determining concentration are discussed.

Note on the Concentration of Hydrogen Ion in Sulphuric Acid: R. C. TOLMAN and L. H. GREATHOUSE.

The results are described of an indicator method of determining the concentration of hydrogen ion in sulphuric acid. A suitable indicator is added to the solution of sulphuric acid in question and the color compared with that of a solution of a uni-univalent acid (HCl or HNO_3) to which the same amount of indicator has been added. By adjusting the concentration of the uni-univalent acid the concentration of a solution isohydric with the sulphuric acid can thus be found, and the concentration of hydrogen ion in this solution calculated from conductivity measurements.

Estimation of Degree of Ionization in Moderately Concentrated Solutions of Electrolytes: E. W. WASHBURN.

The Dissociation Relations of Cæsium Nitrate, Lithium Chloride and Potassium Chloride in Aqueous Solution at 0°: E. W. WASHBURN and D. A. MACINNES.

Diameters of Pores in Osmotic Membranes: F. E. BARTELL.

Some Applications of the Electronic Conception of Positive and Negative Valencies: IV., Fluorescence: HARRY SHIPLEY FRY.

Action of Zinc-copper Couple on Bromoform: WILDER D. BANCROFT.

Viscosity of Solutions of the Metal-ammonia Salts: ARTHUR A. BLANCHARD and HAROLD B. PUSHEE.

Ammonia when added to solutions of salts of alkali and alkaline earth metals causes slightly greater increase of viscosity than when added to pure water. Comparing this fact with the known fact that ammonia added to salts of silver, copper and zinc, causes a marked decrease in viscosity,¹ the conclusion is drawn that while the latter metals form more compact complex ions with ammonia than with water, the alkali and alkaline earth metals form more compact complex ions with water than with ammonia.

¹ Blanchard, *J. Am. Chem. Soc.*, 1904, **26**, 1315.

Some New Ammono Salts: E. C. FRANKLIN.

Ammonates of Barium Trinitride: A. W. BROWNE and E. A. REKATE.

The 0° isotherm of the pressure-concentration diagram for the two-component system barium trinitride, ammonia, has been studied over pressures ranging from 0 cm. to 300 cm. Three solid ammonates were obtained, of the respective composition $\text{BaN}_6 \cdot \text{NH}_3$, $\text{BaN}_6 \cdot 2\text{NH}_3$ and $\text{BaN}_6 \cdot 8\text{NH}_3$. Under certain conditions a curious reluctance was observed, especially on the part of the lower ammonates, either to take up or to give up ammonia.

Ammonated Ammonium Trinitride: A New Hydronitrogen: A. W. BROWNE and A. E. HOULEHAN.

Pressure-concentration isotherms at -33° , 0° and 20° have been studied for the two-component system hydronitric acid, ammonia, over a range of pressures from 0 cm. up to about 175 cm. At the two higher temperatures no indication of the formation of an ammonated ammonium salt was obtained. At -33° , however, a diammonate of the formula $\text{NH}_4\text{N}_3 \cdot 2\text{NH}_3$, or N_6H_{10} , was obtained. This substance was obtained in the form of clear, colorless, somewhat elongated plates, which at -33° are in equilibrium with solid ammonium trinitride and ammonia gas at a pressure of about 22 cm., and with its saturated solution and ammonia gas at about 42 cm. At -33° one gram of liquid ammonia dissolves one and nine tenths grams of the diammonate. At 0° one gram of liquid ammonia dissolves nearly one gram of the "anammonous" ammonium trinitride.

Throughout the research a specially constructed glass apparatus was employed by means of which it was possible accurately to measure the amounts of ammonia introduced into the system or withdrawn from it.

Behavior of Certain Metals in a Liquid Ammonia Solution of Ammonium Trinitride: A. E. HOULEHAN.

Weighed amounts of ammonium trinitride were dissolved in liquid ammonia and were brought into contact, in a specially constructed nitrometer, with weighed amounts, respectively, of metallic lithium, sodium, potassium, magnesium, calcium, zinc, aluminum and tin. The first five metals acted vigorously, liberating hydrogen quantitatively from the hydronitric acid, and forming the corresponding metallic trinitride. Zinc acted very slowly, and aluminum and tin did not act at all.

With non-metals, such as sulphur, phosphorus and iodine, no action was observed.

Ammonolysis of Certain Hydrazine Salts: A. E. HOULEHAN.

The behavior toward liquid ammonia of several hydrazine salts has been studied in a specially designed extraction apparatus. It was found that the monosulphate, disulphate, dioxalate and diselenate of hydrazine readily ammonolyzed, yielding the corresponding ammonium salt and free hydrazine, but that the monophosphate and the diphosphate did not ammonolyze.

Aluminum Anodes in a Liquid Ammonia Solution of Ammonium Trinitride: M. J. BROWN and G. W. PAWEL.

Aluminum anodes were corroded in a liquid ammonia solution of ammonium trinitride, with formation of a grayish scale. This substance was filtered and was washed with pure liquid ammonia in an apparatus designed to exclude all moist air, and to permit the proper sampling of the product. The purified substance, when brought into contact with water, became red hot and decomposed, yielding aluminum hydroxide, ammonia, hydronitric acid, nitrogen and hydrogen. Repeated analysis has shown it to consist, in all probability, of a partially ammoniated aluminum nitride mixed with a small percentage of an ammonobasic aluminum trinitride. This is considered to have been formed by an initial "nitration" of the metallic aluminum by the discharged nitrine ions, and subsequent ammonolysis of the aluminum trinitride formed. An accurate gasometric method for the determination of small amounts of hydronitric acid has been devised during the course of the research.

Oxidation of Arsenious and Antimonious Oxides by Means of Air and Water: J. BISHOP TINGLE and VOLNEY A. RAY.

It is well known that arsenious and antimonious oxides (As_2O_3 and Sb_2O_3) are transformed easily, by many oxidizing agents, into arsenic and antimonie oxides (As_2O_5 and Sb_2O_5), but the authors have failed to find any record of the fact that this change can be brought about by the action of air and water.

The observations on which this conclusion is based were made in the course of some experiments having for their object the preparation of certain organic derivatives of arsenious and antimonious oxides.

The organic compound was mixed with a little alcohol and water, the respective oxide added and

the mixture boiled in a test-tube which was fitted to a reflux condenser of small bore.

After about sixteen hours the liquid still had an odor of alcohol, but the oxides were found to have been converted into the antimonie and arsenic stages of oxidation.

Similar results were obtained by the use of the oxides, water and alcohol (99 per cent.) only, in the ratio 0.5 g., 5 c.c. and 3 c.c., respectively, but the boiling was continued during about 26 hours, at the end of which time the change was practically quantitative.

The Freezing-points of Liquid Sulphur when Soufre Nacre and when Rhombic Sulphur are Deposited: ALEXANDER SMITH and C. M. CARSON.

Crystallized Calcium Tetrasulphide: WILLIAM MCPHERSON, H. MOUGEY and JAMES R. WITHROW.

The Detection of Traces of Copper: A. GUILLAUDEU, WESLEY B. PRITZ and JAMES R. WITHROW.

The Precipitation and Separation of Arsenic Antimony and Tin: J. I. D. HINDS.

Reduction of Nitrobenzene by Ferrous Hydroxide: H. C. ALLEN.

The Action of Ammonia on Arsenic Halides (preliminary report): C. H. HERTY.

"Nipponium": CHARLES L. PARSONS.

A New Thermostat: CHARLES L. PARSONS.

The Hydrolysis of Ethyl Barium Sulphate: W. A. DRUSHEL.

The Action of Water on Apatites: F. K. CAMERON and W. H. WAGGAMAN.

Metallic Properties of some Organic Radicals: H. N. MCCOY, F. L. WEST and C. H. VIOL.

Preparation of Anhydrous Perchloric Acid: H. H. WILLARD.

Polyborates: C. L. PARSONS and C. O. BROWN.

The Solubility of Iodine and Potassium Iodide in the Presence of Each Other: C. L. PARSONS and C. F. WHITTEMORE.

Ozone: HARRY N. HOLMES.

The author of the paper reviewed the present technical uses of ozone such as water purification, ventilation by oxidation of "air sewage," bleaching, deodorizing, aid to cold storage, sterilization, organic synthesis and others. The cost of ozone as made by different methods was discussed.

The various methods of making this gas in the laboratory were enumerated and the author con-

sidered it quite probable, reasoning from the large number of instances in which the generation of oxygen is known to be accompanied by the formation of ozone, that whenever oxygen is released in the atomic or nascent state some of the atoms unite in threes to form ozone. The conditions such as temperature, presence of oxidizable material, etc., do not always permit a successful test.

Various theories of the formation of ozone in nature were given and the author cited recent experiments of his own attempting to throw light on the release of ozone by green leaves. This work and a study of the value of ultra violet light in the formation of the gas in outdoor air is to be continued.

A New Reagent for Potassium: L. L. BURGESS and O. KAMM.

The Effect of the Magnetism upon the Passive State of Iron and Nickel: HORACE G. BYERS and AGNES FAY MORGAN.

A New Method for the Separation of Cerium: C. JAMES and L. A. PRATT.

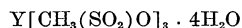
By boiling, a slightly acid or neutral solution of the rare earth oxides in nitric acid, with potassium bromate and marble in the lump condition, cerium is precipitated. The composition of the precipitate varies with the amount of potassium bromate used. With a slight excess of bromate, a basic ceric nitrate is obtained. If the excess of bromate is great, the precipitate contains quantities of the basic bromate.

When this method is carefully carried out, a very pure product of cerium results.

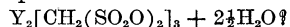
New Rare Earth Compounds: L. A. PRATT and C. JAMES.

The following salts were prepared while searching for some crystalline compounds which might be useful for fractional crystallization of the yttria earths:

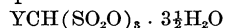
Yttrium methyl sulphonate



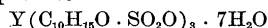
Yttrium methene disulphonate



Yttrium methine trisulphonate



Yttrium camphor sulphonate



Yttrium salicylate .. $Y[C_6H_4(OH)COO]_3 \cdot 3\frac{1}{2}H_2O$

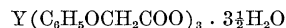
Yttrium phthalate .. $Y_2[C_6H_4(COO)_2]_3 \cdot 3H_2O$

Yttrium glycollate .. $Y(CH_2OHCOO)_3 \cdot 2H_2O$

Yttrium phenyl acetate



Yttrium phenoxy acetate



In addition to the above, the phenoxyacetates of samarium, neodymium, praseodymium, lanthanum and cerium were prepared.

A Convenient Apparatus for the Preparation of Anhydrous Hydrazine: C. F. HALE and F. F. SHETTERLY.

A convenient glass apparatus for the preparation of anhydrous hydrazine by the action upon hydrazine hydrate of any suitable dehydrating agent has been constructed. The action upon hydrazine hydrate (1) of barium oxide, according to the method of de Bruyn, (2) of barium hydroxide and (3) of sodium hydroxide, according to the procedure of Raschig has been studied under comparable conditions. As a blank experiment pure hydrazine hydrate has been subjected to fractional distillation in the same apparatus and under conditions similar to those prevailing in the other experiments.

Anhydrous Formic Acid: J. B. GARNER.

Action of Nitrogen on Lithium Carbide: S. A. TUCKER and H. R. MOODY.

Europium: C. JAMES and J. E. ROBINSON.

The material used in this work comprised the following: oxides from insoluble double sodium sulphates from about 200 kilograms of yttrium minerals; all the samarium and gadolinium oxides derived from about 200 kilograms of Brazilian monazite; and about 110 kilograms of oxides obtained from the more insoluble double potassium sulphates coming from very large amounts of Carolina monazite.

These crude oxides were converted into the double magnesium nitrates and fractionally crystallized in large porcelain dishes. The neodymium, lanthanum and praseodymium rapidly collected in the least soluble portion. The intermediate fractions consisted chiefly of the pale yellow samarium compound, while the most soluble portions were rich in gadolinium and were colored pink by the erbium metals. As soon as the crystals of the simple nitrates of the yttrium elements made their appearance, the isomorphous bismuth magnesium nitrate was added to the most soluble fraction. Upon further crystallization, all traces of samarium and europium were rapidly eliminated from these most soluble fractions and they were set aside since they contained only the yttrium earths.

The most insoluble fractions containing lan-

thanum, cerium, praseodymium and neodymium were separated from the series as soon as they were freed from all samarium. The larger portion of the samarium was gradually removed by a great number of crystallizations. At this point the fractions were transferred to porcelain caseroles covered with watch glasses, and the nitric acid, used as a solvent, was increased from thirty to fifty per cent.

As the work proceeded, the europium band was observed to become stronger in the fractions between samarium and gadolinium. After many ligatures, these middle fractions were found to contain only europium. These portions were dissolved in water, saturated with hydrogen sulphide, and the clear filtrate was treated with oxalic acid. The europium oxalate was then washed, dried, and stored for the study of its compounds.

DIVISION OF ORGANIC CHEMISTRY

Geo. B. Frankforter, *chairman*

Wm. J. Hale, *secretary*

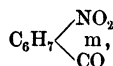
Derivatives of Isocamphoric Acid: W. A. NOYES and W. T. MURDOCK.

Lauronolic Acid and Other Compounds of the Lauronolic Series: W. A. NOYES, C. E. BURKE and R. S. POTTER.

Decomposition of Nitroso Compounds in the Presence of Alcohols: W. A. NOYES and J. A. COSS.

The Acyl Derivatives of O-amino Thiophenol: J. H. RANSOM and L. D. HAMMOND.

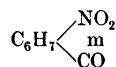
The dibenzoyl derivative has been made and analyzed. The diacyl derivatives, in which the acyl groups C_6H_5CO and



were introduced in reverse order, have been made but not sufficiently purified for analysis. The saponification products of both appear to be the same, though the monoacyl derivative has not been identified with certainty.

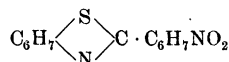
The diacyl derivatives, in which the acyl groups, C_6H_5CO and $COOC_2H_5$, were introduced in reverse order, have been made and one of them purified and analyzed. The saponification products appear to be the same, i. e., benzoic acid and an oil of characteristic disagreeable odor. Oil not yet purified, though it has the properties of a monoacyl urethane.

Likewise there have been introduced, in reverse order, the groups

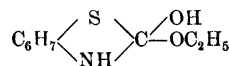


and $COOC_2H_5$, but these derivatives have not been wholly purified. The saponification products appear to be identical, and the monoacyl derivative the disagreeable smelling oil above mentioned.

The anhydro base



has been prepared and analyzed and a substance having the composition of the substance



though this may be the disulphid due to oxidation of the mercaptan hydrogen.

The work will be extended and completed.

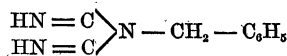
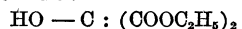
Ethyl Cyantartrionate and its Addition Reactions with Amines: RICHARD S. CURTISS and L. F. NICKELL.

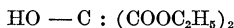
In previous reports we have shown that the keto group of the oxomalononic esters, $O=C=(COOR)_2$, forms intermediate addition products with strongly basic substances as ammonia, and its substituted derivatives; with neutral compounds like the alcohols; and even with strongly negative molecules as the haloid acids. In continuation of this series of studies we have tried the action of hydrogen cyanide on ethyl oxomalonate.

The work was carried out at low temperatures with rigorous exclusion of moisture. The reaction proceeds with gradual loss in color of the green oxomalonate. The product is a colorless, unstable oil of the consistency of concentrated sulphuric acid. It slowly decomposes in the moisture of the air, giving off hydrogen cyanide.

This oil reacts vigorously with dry ammonia gas, giving a red resinous substance. The reaction carried out, however, with one molecule of the gas, in dry ether solution in a freezing mixture gives a white crystalline compound. Owing to its great instability this substance can hardly be kept long enough for an analysis.

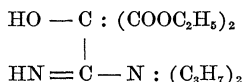
The less volatile benzyl amine under similar conditions gives a white, crystalline compound of greater stability. The analysis corresponds to the following formula:





A benzene solution of this product gives a white crystalline precipitate with dry hydrogen chloride, probably an amidine salt.

Dipropyl amine, on the other hand, adds to ethyl cyanatartraonate in molecular proportions, giving likewise a white crystalline substance. It is less stable than the benzyl amine compound, and gives a similar crystalline product with dry hydrogen chloride. The analysis corresponds to the following formula:



The study of these and similar reactions is being continued.

Arsenic and Antimony Derivatives of Certain Organic Acids: J. BISHOP TINGLE and K. A. CLARK.

The authors have prepared a number of new arsenic and antimony derivatives of succinic acid.

Similar experiments with camphoroxalic acid and with some of its more complex amino derivatives failed to give positive results.

Phthalphenylamidic acid (phthalanilic acid), under the conditions employed, was converted into the anil.

The experiments were made in an atmosphere of carbon dioxide, in order to avoid oxidation of the arsenious and antimonious oxides. Reference to this is made in another paper, which is presented before the inorganic section of this society.

Professor Abel has examined the therapeutic action of the new compounds mentioned above.

The Action of Halogen Acids upon Oxycanthens: M. GOMBERG and C. J. WEST.

The Condensation of p-Dibromobenzene with Xanthone; a Contribution to the Knowledge of Quinocarbonium Salts: L. H. CONE and C. J. WEST.

The Action of Substituted Hydrazines on Beta-orthotoluquinone: WILLIAM MCPHERSON and CECIL BOORD.

Beta-orthotoluquinone and its condensation products with unsymmetrical benzoylphenylhydrazine and unsymmetrical p-tolylhydrazine are described. The two latter products upon saponification yield benzeneazometacresol ($\text{CH}_3:\text{OH}:\text{N}_2=1:3:4$) and p-tolylazometacresol ($\text{CH}_3:\text{OH}:\text{N}_2=1:3:4$), respectively. A study of these derivatives is being made to determine the nature of orthohydroxyazo compounds.

The Derivatives of Choline: R. R. RENSHAW.

Determination of Structure from Ionization: CLARENCE G. DERICK.

Calculation of Ionization Constants from Structure: CLARENCE G. DERICK.

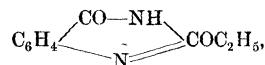
The "Beckman Rearrangement" of Triphenyl Methylhydroxylamine: J. STIEGLITZ and G. A. REDDICK.

A Singular Case of Spontaneous Beckman Rearrangement: LAUDER W. JONES.

Three Isomeric Ethyl Normal-propyl Hydroxylamines: LAUDER W. JONES and CHARLES HECKER.

Oxygen Ethers of the Cyclic Ureas: RALPH H. MCKEE.

Finger and Zeh have described the compound formed by the action of methyl or ethyl anthranilate or cyanimido ethyl ether as o-carbethoxy phenylethanamide. It is now shown that the substance actually formed is ethyl benzoylenisourea,



and not a substituted cyanamide at all. Incidentally carbethoxy and carbmethoxy phenylcyanamide were made by a method, which leaves no doubt as to their constitution, and found to possess the properties customarily observed in mono-substituted cyanamides and not at all those of the compound described by Finger and Zeh.

The Constitution of Dehydroacetic Acid: WM. J. HALE.

The Composition of the Resene of Pinus heterophylla: CHARLES H. HERTY.

The Action of Carbon Tetrabromide and Organic Bases: WM. DEHN and A. H. DEWEY.

The Action of Diiodo Acetylene upon Organic Bases: WM. DEHN.

The Action of Tetraiodo Ethylene upon Organic Bases: WM. DEHN.

The Action of Bromine on Certain Benzhydrols: LATHAM CLARKE and G. J. ESSELEN, JR.

The Action of Ethyl Magnesium Bromide on Anthraquinone: LATHAM CLARKE and PAUL W. CARLETON.

2,2 Dimethyl-3 Methyl Pentane: LATHAM CLARKE and W. N. JONES.

Carbohydrate Esters of the Higher Fatty Acids: WALTER R. BLOOR.