

solutions, which table has been prepared by the Imperial *Normaleichungskommission*. Attention has also been paid to the determination of the alkalinity of first products, to the determination of sucrose in the presence of invert-sugar, raffinose, etc.

About one half of the book is given over to sugar-analysis, or rather, to be more precise, to the analysis of sugar and sugar-containing compounds. The rest of the work treats of the analysis of bone-black, water, limestone, gas-analysis, fuels, fertilizers and so on, and in most of these sections considerable changes and improvements are also to be noted.

A recalculation of all numerical data and problems was made imperative by adoption of 16 as the atomic weight of oxygen.

Paper and print are excellent, and the numerous illustrations a feature of value.

F. G. WIECHMANN.

SOCIETIES AND ACADEMIES.

THE AMERICAN PHYSICAL SOCIETY.

THE spring meeting of the Physical Society was held at Columbia University, New York City, on Saturday, April 25. An unusually large program of fifteen papers was presented, and the attendance was above the average.

The first article was by H. T. Barnes and E. G. Coker, and dealt with the 'Flow of Water through Pipes in Stream Line Motion with Special Reference to the Critical Velocity.' By taking every precaution to have absolutely quiet water in the tank which supplied the pipe studied, it was found possible to increase the critical velocity much beyond the limit found by previous observers. The presence of little disturbances in the water entering the pipe seems to have a strong tendency to break up stream line flow into an irregular eddy flow. For small pipes the authors found that two critical velocities might be observed. As the velocity was increased from a low value a speed was reached at which stream line flow ceased and eddies formed. If the velocity was increased still more, another critical stage was reached, beyond which the flow again occurred in stream lines.

Messrs. H. T. Barnes and D. McIntosh described a form of platinum thermometer especially designed for work with the continuous flow calorimeter and avoiding many of the difficulties met with in previous forms.

In a paper on 'Architectural Acoustics' G. W. Stewart described a series of experiments made in the auditorium of Sibley College at Cornell University. The reverberation in this hall when first completed was so bad that a speaker could hardly be understood at all. It seemed to offer a good opportunity to test the methods and conclusions developed by Sabine in his work on architectural acoustics. Mr. Stewart found a complete agreement between the results obtained by experiment and those computed upon the basis of Sabine's theory.

A paper on the 'Spectral Energy Curve of a Black Body at Room Temperatures' was also presented by Mr. Stewart. In order to obtain radiation from a body at room temperature the vane of a radiometer was used as a radiating surface, while in front of the slit of the mirror spectrometer used was placed a body at the temperature of liquid air. Under these circumstances, since the radiation from so cold a body is practically nil, the cooling of the radiometer would be due to its own radiation, and the deflections observed in the different parts of the spectrum would measure the radiation for particular wave-lengths. The curve showing the distribution of energy in the spectrum had the same general form as that observed at higher temperatures. The maximum occurred at 9.2μ , the position of the maximum differing from that computed by Wien's formula by about 0.6μ . The energy curve was compared with that computed from Planck's theory, and variations of ten per cent. were noticed, although the curves were alike in general form. In view of the fact that the maximum deflection obtained was not quite 4 mm., such differences were not surprising.

The results of determinations of the specific heats of certain organic solids were presented by W. F. Magie. Fourteen substances were examined, the Pfaundler calorimeter being employed. The results were compared with

the theory advanced by Staigmüller, showing a reasonably close agreement. The heats of solution in water were also determined.

An article by E. H. Hall 'On C_v for Liquids and the a of Van der Waals' called attention to a disagreement between observation and certain conclusions based upon Van der Waal's equation.

Mr. A. W. Smith described the methods used in a careful redetermination of the Heat of Fusion of Ice. An electrical method was employed, every precaution being taken to obtain results in absolute units. A calculation based upon a preliminary determination gives 334.25 joules for the heat of fusion of ice prepared from pure distilled water.

Mr. J. S. Shearer reported the results of a determination of the 'Heat of Vaporization of Nitrogen,' the method being that previously used by him in determining the heat of vaporization of oxygen. The value found was 49.8 calories per gram. Since the latent heat of oxygen is much greater than this, it becomes a matter of interest to determine the heat of vaporization of air as a function of its composition. This determination had been carried out by J. S. Shearer and F. R. Strayer, who reported that the heat required to vaporize air is the same as would be required to vaporize the constituents separately.

It has long been known that ordinary slow evaporation is not accompanied by electrification. When a mass of water is suddenly shattered, however, as in jets, marked electrical effects are produced, but these persist only for a short time. The question then arises whether electrical effects may not be present in ordinary cases of evaporation, vanishing so quickly as to be undetected. Experiments to test this point, by investigating cases of sudden evaporation or condensation, were described in a paper by Carl Barus. No electrical effects could be detected.

Mr. Barus also presented a paper showing that condensation nuclei are produced by the mixture of ordinary coal gas and air. The nuclei are not ionized. They are probably due to chemical action resulting from the presence of sulphur in the gas.

'A Preliminary Note on the Selective Ab-

sorption of Organic Compounds in the Infra-red' was presented by W. W. Coblentz. Thirty-eight substances had thus far been studied, observations extending to a wavelength of 15μ . The results were of especial interest in the case of related compounds, for example, the substitution derivatives of benzene. Certain radicals, such as CH and CH_2 , were found to produce well-defined bands in the absorption spectrum of any substance in which they appeared. In some instances series of bands were found in which the wavelengths were simple multiples of one another (e. g., CH_2 bands were found at 3.5μ , 7.0μ , 10.5μ). As its title indicated, the report is preliminary. Mr. Coblentz is to continue the work with the aid of a grant from the Carnegie Institution.

The remaining papers on the program were: 'An Attempt to Construct an Electrostatic Transformer,' J. E. Ives; 'Note on the Bending of Rock Salt,' W. W. Coblentz; 'A Modification of the Quadrant Electrometer without Liquid Contacts,' C. Barus.

At the meeting of the council fifty-five new members were elected. This number of elections exceeds that of any previous meeting, and doubtless indicates the appreciation by the physicists of the country of the recent arrangement made by the society with *Science Abstracts* and the *Physical Review*. The proceedings of the society are now published in the *Physical Review*, which is sent to all members. The Physical Society also cooperates with the Institution of Electrical Engineers and the Physical Society of London in the support of *Science Abstracts*. Membership in the Physical Society thus carries with it a subscription to both the *Review* and the pure science part of *Science Abstracts*, at a total cost of only a little more than half the regular price of these two journals.

Under these circumstances it is evident that the question of discrimination in the election of new members becomes an important one. The question was discussed at some length, and the sentiment in favor of a distinctly conservative policy was unmistakable. The Physical Society is not to be an honorary society, such, for example, as the National

Academy. But effort is to be made to keep it a *working* society, and not merely an association of men having some general interest in physics. It is expected that new members will in general be chosen only from the active workers in physics—from such as have either already contributed to the advancement of the science or have shown especial promise of becoming investigators later. That exceptions to this policy may occasionally be made is of course probable, but it was felt that such exceptions should be rare.

ERNEST MERRITT,
Secretary.

NORTH CAROLINA SECTION OF THE AMERICAN
CHEMICAL SOCIETY.

THE spring meeting of the section was held in the chemical lecture room of the University of North Carolina, Chapel Hill, on May 8, 1903, at 8:15 P.M., with Presiding Officer Charles E. Brewer in the chair. After the transaction of some miscellaneous business, the following papers were presented and discussed:

A Simple Hydrogen Sulphide Apparatus:
CHAS. E. BREWER.

This apparatus is an adaptation of well-known principles. Its peculiar interest lies in the fact that it may be used on the laboratory desk. The parts are a bottle (250 c.c.) with a two-hole rubber stopper to fit, a separatory funnel (100 c.c.) passing through one of these holes to the bottom of the bottle to serve as a reservoir for the acid, an Erlenmeyer flask (any size desired) with a one-hole rubber stopper to fit, glass and rubber tubing to connect bottle and flask, with as many wash bottles between as may be desired. The bottom of the bottle is covered with shot to a depth of one inch, so as to keep the acid off the sulphide while the gas is not needed. The delivery tube passes through the stopper to the bottom of the flask which contains the solution to be treated. The stopper is inserted loosely until the air in the flask is driven out, then tightly to prevent escape of gas, which comes over as fast as it can be absorbed. It hastens saturation to shake the flask from time to time.

The Assimilation of Nitrogen by Bacteria:
G. S. FRAPS.

This refers to bacteria which assimilated nitrogen without symbiosis. The effect of the nature of the medium, the time, the temperature and the soil used for inoculation of the medium were studied. Addition of magnesium sulphate to a medium containing glucose, potassium phosphate, ferric chloride, sodium chloride and calcium carbonate increased the amount of nitrogen assimilated.

Nitrification of Different Fertilizers: W. A. WITHERS and G. S. FRAPS.

The nitrification of different fertilizing materials was compared in four soils. There was some variation. Placing the amount of nitrogen nitrified in cotton seed meal at 100, the amount of ammonium sulphate nitrified varied from 13 to 127; dried blood, 70 to 120; fish, 85 to 190; bones, 22 to 43, while less nitrification took place when barnyard manure was present than when it was absent. Very much larger amounts of manure were used than are used in farm practice, and with smaller amounts different results would perhaps be obtained.

Nitrifying Powers of Typical North Carolina Soils: W. A. WITHERS and G. S. FRAPS.

The nitrifying powers of fifteen typical soils, collected and classified by the Bureau of Soils, and the North Carolina Department of Agriculture, under the same conditions as regards temperature, water content, number and kind of germs, and time, varied from 11 to 106, compared with a standard soil placed at 100. The soils with the lowest nitrifying powers are sands, with low water capacity, low humus, low absorptive power for ammonia and low acidity, though a soil low in any or all of these does not necessarily have a low nitrifying power. Acidity of the soil did not prevent nitrification.

Report—Progress of the Dyeing Industry:
G. S. FRAPS.

A discussion of the most important lines of advancement, particularly as regards the introduction of sulphur colors, the production of mercerized cotton and artificial silk, and the manufacture of synthetical indigo.

Derivatives of Trichlorethylidene di-p-nitrophenamine: A. S. WHEELER and M. R. GLENN.

This body, on treatment with alcoholic potash, gives a monohydroxy-derivative by replacement of one chlorine; with sodium methylate, a monomethoxy-compound; with bromine, a dibrom-derivative with bromine in the rings; with zinc dust, a compound containing no chlorine.

Determination of Glycerine: A. S. WHEELER and W. R. WELLER.

Chaumeil's method in which iodic acid is used was found to give high results.

Mercurous Sulphide: CHAS. BASKERVILLE.

This body was formed by the prolonged action—through five years—of concentrated sulphuric acid (99.65 per cent.) upon pure mercury.

Recent Work on the Rare Earths in the Chemical Laboratory of the University of North Carolina: CHAS. BASKERVILLE.

An abridgment of his recent lecture before the New York Section with two additions; first, a new method for purifying neodidymium (with Stevenson), and second, an elaboration of that portion touching radioactive bodies and fluorescence. The paper was fully illustrated with specimens and a few experiments.

Note on the Thermodynamical Calculation of the Latent Heat: J. E. MILLS.

Attention was called to the fact that when the constants for Biot's formula were known, differentiation of this equation would give $\delta p/\delta t$. Substitution in the ordinary thermodynamical equation for calculating the latent heat could then be directly effected, with a great saving in the calculations involved.

Molecular Attraction: J. E. MILLS.

If at any temperature the internal latent heat of vaporization be divided by the difference of the cube roots of the densities of liquid and vapor, the result should equal a constant, according to a published theory of molecular attraction (*Jour. Phys. Chem.*, April, 1902). It was shown that the latent heats for ether, benzene and carbon tetra-

chloride gave a good agreement with the theory to within a few degrees of the critical temperature.

Some New or more or less Novel Forms of Laboratory Apparatus: J. M. PICKEL.

- (a) An unusual form of siphon.
- (b) A modified form of a previously described filter-washer.
- (c) An automatic measurer and dispenser of the acid used in Kjeldahl nitrogen determinations.
- (d) Same for the alkalies.
- (e) A stand for Kjeldahl digestion flasks.
- (f) A file for samples contained in bottles.
- (g) A desiccator for equalizing inside and outside air pressure.
- (h) An appliance for utilizing the incandescent electric light as source of heat in fat extractions with ether.
- (i) An asbestos furnace for gold assays.
- (j) An economical but efficient blast-lamp.
- (k) Spiral support for round-bottom flasks.

An Efficient Asbestos or Graphite Muffle: J. M. PICKEL and C. B. WILLIAMS.

This muffle has been used principally in the determination of potash in fertilizers. It is very efficient and has given satisfaction in other respects. A description of it will soon appear.

After the completion of the program Dr. Charles Baskerville tendered the members of the section and their friends an informal 'smoker' at his residence.

C. B. WILLIAMS,
Secretary.

THE GEOLOGICAL SOCIETY OF WASHINGTON.

At the 144th meeting of the society, held in assembly hall of the Cosmos Club, Wednesday evening, May 6, 1903, the following program was presented:

Professor Lester F. Ward: 'Correlation of the Potomac Formation in Maryland and Virginia.'

In this paper Professor Ward outlined the present status of the Potomac formation, as determined from numerous rich collections made in recent years, chiefly by the Maryland workers, and studied and reported upon by Professor Fontaine. The position and extent of the Potomac belt within Maryland and

Virginia and the principal localities represented in the collections were shown by maps. The entire review, with Professor Fontaine's reports, and numerous plates, will be published shortly as a professional paper of the U. S. Geological Survey.

Mr. M. R. Campbell: 'Pocono Rocks in the Allegheny Valley.'

Recently Mr. David White and Mr. Campbell obtained fossils from the Allegheny Valley which show (1) that Pocono rocks having a thickness of at least 130 feet are present in Armstrong County, Pa.; (2) that the Pottsville is 140 feet in thickness and consists of the Homewood and Connoquenessing sandstones separated by the Mercer coal group; and (3) that the well-marked Pocono and Pottsville are separated by a mass of sandstone and sandy shale having a thickness of about 80 feet and apparently barren of fossils. Although these beds can not be classified definitely, there are some reasons for referring them to the Pocono. If this reference is correct the Mauch Chunk shales and Sharon conglomerate are absent and the Connoquenessing sandstones rest directly on rocks of Pocono age.

Mr. David White: 'Age of the Mercer Group.'

Under this title Mr. White communicated certain conclusions and correlations resulting from the study of the fossil plants of the group. He described the pteridophytes of the Mercer flora as a mixture of distinctly upper Pottsville elements with the earliest, and often slightly archaic, representatives of the common species of the Allegheny. Considerable change is noted between the plants in shales resting on the top of the Connoquenessing at certain localities and those immediately underlying the Homewood sandstone at others, the duration of Mercer time, as indicated by the floras, being greatly disproportioned to the relatively small thickness of the group in Pennsylvania and Ohio. Such a comparative duration is, however, in part suggested by the composition of the group, which embraces coals, limestones, iron ores and fire-clays in the northern region. The associated fossil plants indicate that the refractory or 'flint' clays worked at many points

in Somerset, Cambria, Centre, Clearfield and Jefferson counties, as well as the famous Mount Savage clays in western Maryland, belong to the Mercer group, which is shown to be the stage of a belt of refractory fire-clays extending irregularly from the Potomac basin, in northern West Virginia, northward around the border of the main bituminous field through McKean County and as far as St. Charles on Red Bank Creek in northern Armstrong County.

The Mercer group is correlated by the author of the paper with the lower stage of the Westphalian (Sudetic) or the Lower Coal Measures of Europe. The more complete knowledge of its flora throws much light on the age of the Kanawha formation in the southern Virginia regions, additional collections from which have recently been examined. In a discussion of the age of the Kanawha in 1899, the speaker had shown that the greater portion, embracing not less than 600 feet, of the formation, antedated the Allegheny formation, although the northern equivalents of the formation were not definitely known. It now appears that its partial equivalence with the Mercer, then conservatively proposed, is conclusively shown by the plants, and that a great portion of the Kanawha formation is to be regarded as the southern extension of the Mercer group. The further study of the floras indicates not merely that the middle of the formation may be of Mercer age, but that beds up to within 125 feet of the 'Black Flint' are clearly referable to the latter group, while the basal Allegheny time boundary is probably very much nearer the level of the Black Flint.

During the evening of May 13 a special meeting was held in continuation of the 140th regular meeting, which was devoted to a discussion of the 'Quantitative Classification of Igneous Rocks.' No formal papers were presented, but the practical workings of the new classification were commented upon by several petrographers who had tested it, and observations, critical and commendatory, from foreign workers were read and discussed.

W. C. MENDENHALL,
Secretary.

PHILOSOPHICAL SOCIETY OF WASHINGTON.

THE 569th regular meeting was held May 9, 1903. The first paper was by Dr. H. Carrington Bolton, on 'The Genesis of Hygrometers and Anemometers.'

The earliest recorded instruments for measuring the moisture in the atmosphere were those of Nicolas de Cusa, about 1450; they were bits of wool and of sponge fastened to one arm of a balance. Leonardo da Vinci invented a more perfect hygrometer, consisting of a metallic ring with a graduated scale which bore at its center a movable rod, to the ends of which were fastened small spheres of metal, one covered with wax and one with cotton wool. Leonardo thought the wax repelled moisture and the cotton absorbed it.

Sanctorius in his 'Medicina statica' (Venice, 1614) mentions three hygroscopic substances, the 'dregs of alum,' thin boards and strings of a lute.

The Italian physicists of the Accademia de Cimento employed a conical vessel filled with ice for condensing the moisture of the air. The ingenious Robert Hooke describes in his 'Micrographia' (1664) a hygrometer, the essential feature being the awn of wild oats.

The weather-mannikin, still common in Germany, was invented in 1685 by Wm. Molineux. In the eighteenth century a very great variety of hygroscopic bodies were employed, from wood through guts of animals to marine algae and deliquescent salts, but De Saussure's hair hygrometer was found to excel.

John Dalton in 1801 proposed noting the dew point, and Leslie's psychrometer was invented about the same date. Daniell's condensing hygrometer dates from 1820.

The earliest anemometers were those invented about 1578 by Egnatio Danté, a Dominican monk. It is similar to that of Wild's tablet-anemometer reinvented in 1860. The speaker described briefly a large number of instruments for measuring the velocity of the wind down to Robinson's cup anemometer now in use, first brought out in 1850.

Dr. Bolton called attention to the fact that every one of the fundamental instruments

now used in meteorological observations is of Italian parentage:

- 1450.....Hygrometer, Nicolas de Cusa.
- 1578.....Anemometer, Egnatio Danté.
- 1595.....Thermometer, Galileo.
- 1639.....Raingauge, Cartelli.
- 1643.....Barometer, Torricelli.

Mr. E. E. Hayden, of the Naval Observatory, then described, with aid of lantern observations, the 'Naval Chronometer and Time Service.' The Navy possesses about 800 chronometers, and for the rating of these elaborate provision is made at Washington; further facilities are provided at Mare Island Navy Yard, Cal., and at Cavite. The tests used were described, diagrams were exhibited to show the actual behavior of instruments under service conditions, and the details of the daily telegraphic time service were explained.

The last paper of the evening, by Mr. J. F. Hayford, dealt with the unusual features of the plans of a primary triangulation party of the Coast and Geodetic Survey on the 98th meridian triangulation in 1902. The triangulation was done at considerably more than double the usual rate for such work in the past, and at half the usual cost per station occupied under similar conditions. The work of a single season furnishes an arc of the meridian 6° long, twice as long as the famous Peruvian arc. The accuracy of the work is fully up to the best standards of the past. The observations were made upon heliotropes in the day hours and upon acetylene lights at night. The light keepers were given their orders by heliograph signals. Many of the observations were taken under apparently bad conditions upon very faint images, or images which were very large and fluctuating wildly. The observing towers, 42 feet high upon an average at each station, were erected by a separate building party of seven men, at an average rate of ten per month, the towers being scattered throughout the whole extent of the arc 446 miles long. No screens were found to be necessary to shelter the inner tower from the sun and wind, although such screens have been regularly used in the past.

THE 570th meeting was held May 23, 1903. The evening was devoted to memorial addresses on deceased members as follows: By Dr. A. F. A. King, on Dr. S. C. Busey, lecturer, sanitarian and author; by Mr. B. R. Green, on Mr. Edward Clark, for many years architect of the Capitol; by Professor F. H. Bigelow, on Professor William Harkness, late of the Naval Observatory; by Mr. H. L. Marindin, on Professor Henry Mitchell, hydraulic engineer, latterly of the Massachusetts Institute of Technology; by Dr. Swan M. Burnett, on Mr. Charles Nordoff, journalist and author; by Mr. G. W. Littlehales, on Admiral W. T. Sampson, U.S.N.

Notices of Major J. W. Powell and Mr. J. W. Osborne that had been expected were unavoidably postponed. CHARLES K. WEAD,

Secretary.

ANTHROPOLOGICAL SOCIETY OF WASHINGTON.

THE 346th regular meeting was held on April 28.

Professor W. H. Holmes gave an account of his explorations in a hematite mine in Franklin County, Missouri, where there are ancient workings consisting of pits and drifts honeycombing the whole mass of ore. Numerous stone hammers, flint and chips were found about the pits, and it is evident that this locality was a favorite one among the Indians for procuring paint which occurs in pockets in the iron ore.

A communication from Mrs. Catherine Foote Coe, giving her impressions of travel in Japan, was heard with great interest, and a vote of thanks was extended to her.

Dr. W. J. McGee announced that the International Archeological Commission for the study and preservation of antiquities, which originated at the Pan-American conference held in Mexico in 1901, has made progress toward organization, and that on the third Monday in December next the representatives of the American republics will meet with adequate powers to complete the organization.

Mr. Ainsworth R. Spofford read a paper entitled 'The Folk-Lore of Popular Sayings.' Mr. Spofford, in calling attention to the great collections of sayings and proverbs in different

languages, spoke of the wealth of such sayings in English and Irish. These, he said, possess a distinct ethical value in that they are almost invariably optimistic. The best sayings are of Latin, Greek or Oriental origin from the ages past. Sayings relating to the inanimate world, the animate world, professions in life and color were given, also rhymed sayings, sayings of noted men, maxims of unknown origin, weather proverbs and sayings referring to the days of the week. In the discussion of the paper Professor McGee remarked that proverbs prevail in lower culture and are wonderfully paralleled among different tribes, and said that we may almost predicate the stage of development of a people by their use of proverbs. In answer to a question Mr. Spofford said that no one can trace the origin of proverbs. The secretary pointed out the debt of language and literature to these pithy sayings, which are in reality word sentences. Mr. Pierce said that in many cases proverbs show their locality of origin, and Mrs. Tulloch gave examples. The president, Miss Fletcher, said that among Indians ethical proverbs are used in teaching, as, 'Stolen food does not satisfy hunger,' an expression of the Omaha.

'Some Exploded Theories concerning Southwestern Archeology' was the title of a paper by Mr. U. Francis Duff. These myths are the exaggerated estimates of early population, a distinct race of cliff dwellers, dwarf tribes, the destruction of tribes by cataclysms or pestilence, the destruction of villages by lava, the Gran Quivera myth, and the finding of gold in the southwestern ruins. Professor McGee, in discussing the paper, said that in the valley region the extensive irrigation works show that the population was very large, as it would not be necessary to take water far out in the valley to higher levels if the land were not occupied in the near valley. In answer to a question by Mr. McGuire as to the Spanish origin of the ditches, Professor McGee said that the irrigation works show no traces of European culture. Other points were taken up and discussed by members.

WALTER HOUGH,
Secretary.