notes on the additions in various departments and lists of the various lecture courses.

SOCIETIES AND ACADEMIES.

THE NEW YORK ACADEMY OF SCIENCES. SECTION OF ASTRONOMY, PHYSICS AND CHEMISTRY.

THE regular monthly meeting of the section was held at Fayerweather Hall, Columbia University, on Monday evening, November 7, with Professor Charles L. Poor in the chair. Abstracts of the papers which were presented before the section are as follows:

The Relation of Kathode Resistance to the So-called Saturation Current in the Discharge through Gases: F. L. TUFTS.

In this paper it was pointed out that the so-called saturation currents obtained by Wilson and other investigators of the phenomena of electrical conduction through flame gases were not true saturation currents, but only apparently so, owing to the development at the kathode of a high resistance when the impressed electromotive forces were over a few volts. By the use of a kathode coated with calcium oxide and heated by a separate flame it was shown that the resistance of a flame connecting this with the anode remained practically constant; that is, the current through the connecting flame increased directly as the potential gradient for gradients ranging from a few tenths of a volt to the centimeter, up to gradients of as much as fifty volts to the centimeter.

Experiments were made with the ordinary luminous gas flame as well as with flames rendered non-luminous by the admixture of air, and the relation between current and potential gradient was found to be the same for both kinds of flames.

The Duration of the Afterglow Accompanying the Electrodeless Discharge at Low Pressures, Effect of Temperature: C. C. TROWBRIDGE.

The purpose of the investigation was to determine the nature of the glow that often appears after the cessation of the electrodeless discharge in gases at low pressures. Measurements made thus far on the duration of the glow in air show a sharp maximum of duration between .1 and .05 millimeter pressures and that this maximum point varies with the electrical conditions of the experiment. It was also determined that there is a critical point between .7 and .3 millimeter pressures where the glow is only occasionally formed, after which as the pressure is further reduced, the duration of the glow increases rapidly to the maximum. The electrodeless discharge was also made to take place at liquid air temperature and it was found that the afterglow accompanying the discharge was diminished considerably in duration and intensity at the low temperature of about $-186°$ C.

The officers of this section for 1905 were then elected and are as follows:

Chairman—Ernest R. van Nordroff.
Secretary—Charles C. Trowbridge.

THE next regular meeting of the section was held on Monday, December 5, with Professor William Hallock in the chair in the absence of Professor Poor.

The papers of the evening were as follows:

The Combination of Ions with the Solvent in Solutions: C. W. KANOLT.

The object of Dr. Kanolt's investigation was to determine whether or not the ions of a salt in solution are combined with the solvent. The method used was the electrolysis of a salt dissolved in a mixture of two solvents, with the subsequent analysis of the portions of the solution around the two electrodes. If the ions are combined with either of the solvents, this solvent will be carried from one electrode to the other, and changes in the proportions of the two solvents are to be expected. Positive results were obtained with silver nitrate dissolved in a mixture of pyridine and water, indicating that pyridine was combined with the silver ions. With the same salt in a mixture of alcohol and water only negative results have so far been obtained. Other salts are being investigated.

Chemical Combination of Knall-gas under the Action of Radium: BERGEN DAVIS and C. W. EDWARDS.

The experiments described relate to the chemical combination of hydrogen and oxygen

under the action of radium rays. The gases were enclosed in a vessel in such a way that a small change of pressure could be observed. About four milligrams of radium bromide were dissolved in alcohol and deposited on the surface of a small sheet of platinum which was placed in the vessel.

By means of electrodes the amount of ionization produced in the gas by the radium was measured. While the rate of formation of water was quite slow, yet the number of molecules of water formed for each physical ion produced was very large. The experiments are being continued by Professor Edwards.

C. C. TROWBRIDGE,
Secretary.

THE PHILOSOPHICAL SOCIETY OF WASHINGTON.

AT the 593d regular meeting, the 34th annual meeting, held December 24, 1904, the following officers were elected:

President—G. W. Littlehales.

Vice-Presidents—Cleveland Abbe, J. G. Hagen, A. L. Day, L. A. Bauer.

Treasurer—Bernard R. Green.

Secretaries—Charles K. Wead, Lyman J. Briggs.

General Committee, besides those named above—W. A. De Cundry, H. M. Paul, J. Winston, L. A. Fischer, R. A. Harris, E. B. Rosa, C. G. Abbott, K. E. Guthe, W. S. Eichelberger.

The secretaries' and treasurer's reports showed that the society is in a prosperous condition, having had a considerable increase of membership during the past year.

THE 594th regular meeting was held January 7, 1905.

The first paper was by Mr. E. P. Hyde, of the Bureau of Standards, by invitation, on 'Some Problems of Photometry.' These related mainly to the rating of electric incandescent lamps, and to practical methods of obtaining the mean spherical illumination applicable to the various forms of lamps with their widely differing filaments and distribution curves. In the Matthews photometer there are a number of pairs of mirrors, the centers of one set lying in a meridian of the lamp and throwing the rays to the mirrors of the other set, whence they go to the screen. The lamp is rotated about 180 times per second. The speaker had determined the angular position of the mirrors of the first set that would give theoretically accurate results for three extreme cases of distribution, and then found an average position that reduces materially the small errors of the Matthews instrument.

Mr. W. J. Spillman, in charge of the forage plant investigations of the Department of Agriculture, then spoke on 'Utilizing the Desert,' dealing with the cactus and its uses, and showing many slides.

It has been found that the cactus plant possesses considerable value as feed for cattle, sheep and hogs. It is universally used by Mexican freighters in southwest Texas for their work oxen, and in famine years it is used by stockmen generally to tide over the dry periods, and for this purpose it possesses great value. The possibility of utilizing cactus frequently saves the wiping out of vast herds of cattle in time of famine. Several methods are in vogue for getting rid of the spines preparatory to feeding cactus. One of the most common is to scorch off the spines over a brush fire. A modification of the plumbers' torch is more or less extensively used for treating cactus in place. Many stockmen use a specially constructed cutting machine which pulps the cactus and abrades the spines so that the juices of the plant quickly render the spines innocuous. The pulped material is readily eaten. Some steam the cactus in large vats, which so softens the spines that they become harmless. Some varieties of cactus will thrive with one rain a year; and averaging a period of years an acre of cactus is equal to an acre of ordinary forage plants.

AT the 595th meeting, January 21, 1905, Dr. Guthe exhibited a bar of Heusner's alloy composed of 60 per cent. copper, 27 per cent. manganese and 13 per cent. aluminum, which is strongly magnetic, though none of its constituents is so.

Mr. Abbott exhibited and described 'A Comparator with Planimeter Attachment' especially devised for reading ordinates, abscissæ and areas of curves on 10-inch by 24-inch

photographic plates. In connection with the spectrobolographic determinations of the solar constant of radiation at the Smithsonian Observatory, it is desired to know the variations in ordinates of bolographic curves corresponding with the intensity of rays of different wave-lengths in the solar spectrum, and further to sum up the areas included under such curves corresponding to the total energy of radiation reaching the bolometer.

The machine shown was constructed after Mr. Abbott's general design by Warner & Swasey, and consists, like the ordinary comparator, of a microscope moved by screws in ordinates and abscissæ, but this is here combined with a cone and rolling disk. The disk moves horizontally along the elements of the cone as governed directly by the position of the microscope in ordinates, while the number of revolutions of the cone is proportional to the motion of the microscope in abscissæ. Accordingly the number of rotations of the disk is proportional to products of ordinates and abscissæ, and by passing along the contour of the curve between given abscissæ, and back over the zero line to the original starting point, the difference in reading of the disk counter yields the area.

As constructed, the machine is best suited to areas of more than ten square centimeters, but a smaller machine would doubtless be equally successful. The accuracy of measurement actually reached with the instrument shown is 0.1 square centimeter, and numerous measurements of circles and other areas to this degree of accuracy were cited.

Mr. F. E. Fowle, Jr., also of the Smithsonian Observatory, then discussed 'The Discrepancy between Solar-Constant Measures by the Actinometer and by the Spectro-Bolometer.' He referred to Mr. Langley's proof that actinometric extrapolation by Bouguer's formula gives necessarily too low values for the extra-atmospheric solar radiation. It is, however, found by comparison with spectrobolometric determinations that the discrepancy is nearly constant and is about 14 per cent. for such atmospheric conditions as exist at Washington, when Ångstrom's actinometer is used.

Further refinements to the correction may later be determined as functions of the slope of the actinometer curve, the humidity and the air masses serving for the extrapolation.

Charles K. Wead,
Secretary.

THE BIOLOGICAL SOCIETY OF WASHINGTON.

The 395th regular meeting was held at the Assembly Hall of the Cosmos Club on January 14, 1905, with President Knowlton in the chair and forty-six persons present.

Dr. A. D. Hopkins showed specimens of what are undoubtedly fossil borings, probably by some beetle of the family Cerambycidæ.

Professor W. P. Hay renewed a discussion from a previous meeting, and stated that proper credit is given in the scientific world to Cæsalpinus for the discovery of what we commonly know as the circulation of the blood.

Mr. C. O. Townsend presented a paper on the 'Distribution and Development of the Sugar Beet Industry,' in which he called attention to the difference between the sugar beet and the beet sugar industries. Of the latter he illustrated by lantern slides some of the largest beet sugar factories, the largest being in southern California. He then showed a very instructive series of slides dealing with the sowing, cultivation, harvesting and shipping of the sugar beet crop, including views of the workers employed, machinery used and results gained.

Mr. A. C. Veatch discussed 'The Question of Origin of the Natural Mounds of Louisiana, Arkansas and Texas' (illustrated with photographs). Of the many theories of origin suggested for these mounds three deserve the most careful attention: (1) the spring and gas vent theory, (2) the dune theory, and (3) the ant hill theory.

In the spring and gas vent theory it is argued that the gas produced by the decay of the large amount of vegetable matter buried in the coastal plain strata has, with the artesian water associated with it, brought to the surface fine sand and built up low cones. Small cones are now forming in this manner at many points in the coastal plain, and they

were pointed to as proving this hypothesis. The fatal objection to this theory is that entirely identical mounds are found in Indian Territory on flat plains underlaid by higher inclined carboniferous shales and sandstones, where the substructure clearly lacks the elements required by this hypothesis.

The dune theory is based on the resemblance of these mounds to the low dunes which collect in the semi-arid region of the west about clumps of low vegetation. The objection to this theory is the great irregularity of wind-made features and the very notable uniformity in size and exact resemblance, one to another, of these natural mounds of the south central United States over an area at least 300 miles wide and 500 miles long. It would seem that in so large an area a wind origin would involve a greater variation in size than has been observed, and necessitate the presence of occasional dunes, or lines of dunes, of noteworthy size, whose origin could not, in any way, be doubted.

In the ant hill theory two possible lines of development were suggested: (1) that the mounds are the work of the atta, or leaf-cutting ants, (2) that they are the remains of hills of the mound-building variety of white ants, the termites. According to Professor W. M. Wheeler, atta hills in western Texas reach a diameter of forty to fifty feet and height of one to two feet; and Mr. E. A. Schwarz, of the National Museum, reports that the atta hills in Cuba often reach a height of ten to twelve feet and a diameter several times as great. These occurrences add greatly to the possibility of an ant origin.

Regarded as the work of mound-building termites, which are now restricted to the tropical regions, these mounds suggest a warmer and moister climate. Modifications such as those which permitted large elephants, camels and animals of the sloth and armadillo families to live in this region would also have permitted these, now similarly restricted mound-building termites, to do the same; and the causes which resulted in the extinction of the larger animals would also, though at a later date, have destroyed the mound-building termites.

Of the theories of origin yet suggested none are entirely satisfactory, and the dune and ant hill theories are the only ones well supported. If either of these hypotheses is correct the mounds are indications of important climatic changes in very recent time. It was suggested that the matter should be approached by the careful excavation of a number of these mounds at widely different points in order to fully determine the relation of the mounds to the beds which underlie them and to the soil surrounding them.

The last paper of the evening was by Mr. A. S. Hitchcock on 'The Twigs of Woody Plants with Deciduous Tips.' Woody plants in our latitude ordinarily form well defined winter buds at the time of elongation of the season's growth in late spring or early summer. Such growth is often referred to as definite or determinate. In some plants such as the willow the growth of the twigs continues during the season and is retarded and finally stopped by the advent of winter. Some plants have the habit of casting or sloughing off the terminal portion of the young twig at a definite point much as a leaf is cast in autumn. Such twigs present a scar at the end and, instead of a terminal bud, as in hickories or walnuts, the uppermost lateral bud continues the growth of the stem. Examples of this method are the elms, basswood and many other woody plants with two-ranked leaves. The tip of the twig is usually cast in the summer when the buds are formed. The speaker called attention especially to the twigs of the common sumac (*Rhus glabra*) gathered in December which showed remarkably long terminal portions of the twigs still attached but with the well-defined delimiting layer separating the healthy ripened wood from the dead terminal portion (five or six inches) which would be cast off during the winter.

E. L. MORRIS,
Recording Secretary.

THE ONONDAGA ACADEMY OF SCIENCE.

THE Onondaga Academy of Science held its January meeting in Lincoln Hall of the high school building, at Syracuse, on the evening of the twentieth. Dr. John M. Clarke

delivered an able address on the subject, 'Niagara Falls of the Future.'

The speaker, disclaiming any purpose of antagonizing the splendid industrial development at Niagara, invited attention to the paramount claim of the world to this famous spot as against the commercial claim which threatens to convert it into dollars, and by so doing make an end of the American Falls. The recent comment of Lord Kelvin, that the falls would have to be absorbed to meet industrial demand, was criticized as the expression of the sterile sentiment which has permitted the destruction of the classic Falls of Lodore and has already half ruined the Falls of Montmorency. The speaker insisted that industrial progress must leave something to the higher life, to the play of the finer emotions, and from such a view point no justification or compensation can be found for the destruction of such a stupendous display of nature's power.

Though it seems to the casual observer that nothing man can do could abate the enormous volume of waters descending in this cataract, and accomplished hydraulic engineers have been known to deride the possibility that the falls would be injured, yet the menace to the perpetuity of the American Falls is immediate and imminent. The volume of water descending at Niagara has been measured on several occasions with slightly divergent results giving as an average which has been accepted in the calculations of the engineers 224,000 cubic feet per second. This falling an average of 150 feet is equivalent to a potential horse-power of 3,800,000, not of between five and six millions as is constantly stated in the estimates and reports of the engineers.

The legislature of New York has chartered nine companies for the development of power at this place, all but two to take water from above the falls and return it below, one of these two proposing not to return it to the river at all, but to carry it to Lake Ontario by another passage, the other purposing to take advantage alone of the fall in the gorge below the cataract. Of these nine companies, no one of which is required to pay a francise to the state for its tremendously valuable privileges and some of which are permitted to take unlimited water for their purposes, but two are now actively producing power, and it is believed that but one other is now preparing to do so. The two producing companies are limited by law in the amount of water they may consume, the last named is not. The producing companies are far within their limitations at the present, but in both the waste of water and of power is appalling. The series of small cataracts which cover the American bank just below the steel arch bridge, which are the waste discharges from the power canals and the unused fall of the power tunnel which discharges near the same spot, indicate that but a fraction of the potential power of the water now taken from the American river is utilized. The salvage of this wasted power, however, has begun, and its utilization will be continued by the building of factories along the edge of the water beneath the cliff. To save the wasting power of these companies the place must be even worse disfigured than it is at present.

The Canadian companies, three in number, have now in part completed their installment; in so doing, however, they have taken from the river great sections of the stream for their forebays and permanent construction. These companies when working will pay a substantial annual return to the commissioners of the Queen Victoria Park.

The immediately contemplated abstraction of water by the six active companies is:

	Cu. ft. per Second
Two American companies	16,300
Three Canadian companies	32,100
	48,400
It is estimated that the third active American company will consume	10,000
	58,400
The Canadian engineers have proposed four additional power works with a total abstraction of water of	29,996
	88,396

The following abstractions from this drainage basin are assumed as constants and are not here taken into consideration.

Chicago drainage canal	6,000
Proposed barge canal	1,200
Welland canal	600
	7,800

It is a matter of measurement that but one fourth of the water in the Niagara River passes over the American Falls. The sill of the falls is ten feet higher on the American side than on the Canadian. How easily the water is driven entirely out of the American channel is seen by the ice dams of the past few years, which, gorging the stream from the upper end of Goat Island to the American side, have turned the water from that channel so that one can cross the bed of the river dry-shod. Let then, from one fourth to one third of the water be permanently abstracted from the river, and the American Falls will be permanently dry. The production of power actual and immediately contemplated by the five companies within their charters will consume 48,400/224,000 of the water, or 1/5 —. With the estimated abstraction of water by the sixth (American) company this fraction becomes 58,400/224,000 or 1/4 —. Should the proposed additional Canadian plans be effected the proportion will become 88,396/224,000 or 1/3 —. In any one of these cases the danger limit is reached and the perpetuity of the American Falls now hangs by the slender thread of improbability that these companies shall produce to their statutory limitations or find a market for their product.

It is authentically stated that 800,000 tourists visit Niagara annually, bringing an enormous revenue to the place. As soon as the world learns that New York and Canada have shorn this famous place of its beauties, this source of industrial prosperity will be gone. While these magnificent schemes of power development are putting to shame a sentiment of proper pride which should be national rather than local, unlimited horse-power lies idle in the region where these companies hope to find their market and in the development of this none of the finer manifestations of natural power and none of the finer sentiments of mankind would be assailed.

The address was a strong presentation of the subject and the press of the city joined in the protest against the destruction of the falls.

J. E. KIRKWOOD,
Corresponding Secretary.

DISCUSSION AND CORRESPONDENCE.

CONSULTING EXPERTS IN LIBRARIES.

TO THE EDITOR OF SCIENCE: Dr. Francis B. Sumner's letter, published in SCIENCE, January 13, seems to offer an appropriate opportunity for calling attention to certain noteworthy developments at the Library of Congress during the administration of Dr. Herbert Putnam. Dr. Sumner urges the desirability of employing, in connection with one of our great libraries, 'a staff of consulting experts, men of the rank of college professors, whose duty it should be to furnish definite bits of information in response to legitimate questions, or, at least, to guide the seeker on his way * * * the establishment of a sort of human encyclopedia as an adjunct to the library.'

While this ideal has not yet been attained at the Library of Congress, a remarkable development in this direction has taken place during the last few years. It is the function of the Division of Bibliography, established in 1900, not only to prepare and publish lists of references on special topics, principally those of current political interest, but also to supply bibliographical information in reply to inquiries received by mail. The reference work of this character has been mainly in the fields of social and political science and history.

As, however, the collection of scientific literature has recently been reclassified and is now in process of being recatalogued, it has become possible to undertake similar work in science. There are on the staff of the library at the present time several specialists representing different sciences, and it is always possible to consult others associated with various branches of the government service. Furthermore, it being part of the policy of the Librarian of Congress to make the collection of bibliographies, indexes, library catalogues, etc., as complete as possible, unusual resources in the way of bibliographical tools are available at the library. A Science Section of the library, in charge of the undersigned, has accordingly been organized recently and one of its functions is to carry on the reference work in this field, both for investigators at the scientific bureaus in Wash-