

# THE TECH

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BOSTON, MASS., MAY 23, 1910.

## RESEARCH WORK IN THEORETICAL CHEMISTRY

By PROF. A. A. NOYES

The primary purposes of this Laboratory are to afford opportunities for the pursuit of advanced studies in theoretical and physical chemistry and for the carrying on of researches in these subjects. During the past year thirteen men, including four candidates for the Ph. D. degree, have been working in the laboratory upon such researches.

One of the main lines of work is the continuation of the research upon the properties of salt solutions in relation to the Ionic Theory, which, with the view of developing that theory, has been in progress for a number of years under the direction of Prof. A. A. Noyes. The special subjects at present under investigation are: (1) the transference numbers of tri-ionic salts by Dr. K. G. Falk, with the purpose of determining intermediate whether irons, such as  $KSO_4$  or  $PbNO_3$ , exist in considerable quantity; (2) the conductivity of mixtures of salts, by Mr. A. C. Melcher, Dr. W. C. Bray, and Mr. F. L. Hunt, with the purpose of establishing the general law of the ionization of salts; and (3) the solubility of salts in the presence of other salts, by Dr. W. D. Harkins, with the purpose of determining empirically the form of the law of solubility effect which must be substituted for the inexact mass-action form of that law. This line of research has again been aided on the financial side by a grant of \$3000 made to Prof. A. A. Noyes by the Carnegie Institution of Washington.

Another of the main lines of research in the laboratory, which is being carried out by graduate students under the direction of Prof. G. N. Lewis, is the experimental determination and computation of a system of values for the free energy of chemical substances analogous to the system of values for the total energy previously developed by thermochemical investigators. The problem is one of fundamental importance to the science of chemistry, since from the free-energy data for the substances the equilibrium of the chemical

reactions in which they are involved can be computed. The special reactions now being studied in this direction are: (1) that between sulphur and water, producing sulphur dioxide and hydrogen sulphide, by Mr. Merle Randall; (2) that between nitric oxide, nitric acid, and water, producing nitrous acid, by Mr. Arthur Edgar; and (3) that between chlorine gas and chloride-ion in aqueous solution, studied by electromotive force measurements, by Mr. F. F. Rupert.

Dr. W. C. Bray has continued the studies of the equilibrium of some chemical reactions begun a few days ago in this laboratory by Mr. G. M. J. Mackay; namely, of those between solid cupric iodide, iodine, and cupric iodine in solution, between potassium iodide and polyiodide in solution, and between iodine and water.

During the past year articles describing theoretical studies upon the newly developed Principle of Relativity have been published by Prof. G. N. Lewis and by Mr. R. C. Tolman; and an article upon the quantitative application of the theory of indicators to volumetric analysis has been prepared by Prof. A. A. Noyes. An experimental study of indicators from this standpoint has been undertaken by Prof. M. S. Sherrill and Mr. L. Rosenstein.

## THE INSTITUTE AS A BUSINESS PROPOSITION

By F. H. RAND

It may be interesting to your readers to see in concrete form some figures from the Institute Treasurer's Report for the last fiscal year.

The total income for the year ending September 30, 1909, aside from special bequests totalled \$545,974.84 and the total expense for the same period was \$575,794.35 the excess of current expenses over current income being \$29,819.51.

Briefly the income is made up as follows:

Tuition,	\$325,434.25
Laboratory Fees, etc.,	15,761.29
Income from former gifts for General Purposes,	79,958.47
Grants from the State and United States,	47,643.01
Gifts from the Alumni under the five-year agreement,	41,147.94
Gifts for designated purposes,	16,201.10
Income from rents, interest, discounts and refunds,	19,828.78
	<u>\$545,974.84</u>

### Expenses:

Salaries and wages accessory to teaching,	\$347,704.79
Administration and Gen. Ex.,	110,769.02
Operation and Maintenance of Plant,	89,943.88
Expenditure Special Dept., Funds, etc.,	27,376.66
	<u>\$575,794.35</u>

It will be seen from these figures that of the total expense of maintaining the Institute (\$575,794.35) the students paid tuition and laboratory fees (\$341,195.54). This will give some idea of the proportion the students pay in relation to the expense of the service rendered by the Institute.

The total resources of the Institute amount to (September 30, 1909):

Land, Buildings and Equipment,	\$1,871,538.65
Notes and Checks receivable,	19,253.97
Stocks and Bonds,	1,972,673.75
Cash on Hand,	82,880.19
	<u>\$3,946,346.56</u>

And in addition to the above, the Treasurer holds in trust for the Alumni Association, the Walker Memorial Fund, amounting to \$120,796.97.

During the past year the Institute has received from friends for general and special purpose, in cash, \$75,888.04. A comparison of the figures given above with those of 1884 just twenty-five years ago, is interesting.

In that year the students' fees amounted to \$94,119.35. Current expenses were \$164,095.44 and the Treasurer's Report shows this item: Cash overdrawn during the year, \$89,205.91. The number of students that year was 579 as against 1462 the past year.

It may be added that the Institute gives directly or indirectly in scholarships approximately \$32,875.

It is also of interest to note that it costs the Institute \$400.68 per student last year, while the tuition fee is \$250.

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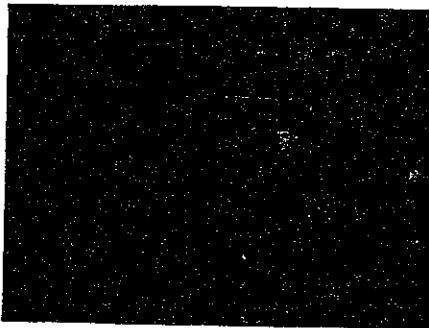
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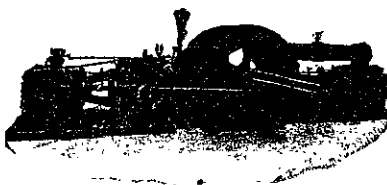
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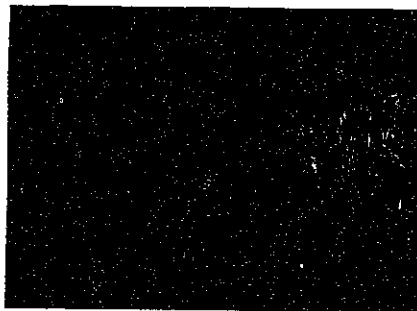
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