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Graduate Courses in Chemistry

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FACULTY OF THE DEPARTMENT OF CHEMISTRY

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Ph.B., University of Georgia, 1886; Ph.D., Johns Hopkins University, 1890; Instructor in Chemistry, University of Georgia, 1891-1894; Adjunct Professor of Chemistry, *ibid.*, 1894-1902; Student, University of Zurich and University of Berlin, 1899-1900; Professor of Chemistry, University of North Carolina, 1905—; Dean of the School of Applied Science, *ibid.*, 1908-1911.

Francis Preston Venable, Ph.D., D.Sc., LL.D., Francis Preston Venable Professor of Chemistry.

Student, University of Virginia, 1874-1879; University of Bonn, 1879-1880; A.M., Ph.D., University of Goettingen, 1881; Student, University of Berlin, 1889; LL.D., University of Pennsylvania, 1901; D.Sc., Lafayette College, 1902; LL.D., University of South Carolina, 1905; LL.D., University of Alabama, 1906; LL.D., Jefferson Medical College, 1912; Professor of Chemistry, University of North Carolina, 1880—; President, *ibid.*, 1900-1914.

Alvin Sawyer Wheeler, Ph.D., Professor of Organic Chemistry.

A.B., Beloit College, 1890; Student, University of Chicago, 1895; Student, Cornell University, 1897; A.M., Harvard University, 1897; Assistant in Chemistry, *ibid.*, 1897-1900; Ph.D., *ibid.*, 1900; Associate Professor of Chemistry, University of North Carolina, 1900-1912; Professor of Organic Chemistry, *ibid.*, 1912—; Student, University of Berlin, University of Bonn, Swiss Federal Polytechnic, 1910-1911.

James Munsie Bell, Ph.D., Professor of Physical Chemistry.

B.A., University of Toronto, 1902; M.A., *ibid.*, 1905; Assistant in Chemistry, Cornell University, 1902-1903; Graduate Scholar in Chemistry, *ibid.*, 1903-1904; Sage Fellow in Chemistry, *ibid.*, 1904-1905; Ph.D., *ibid.*, 1905; Associate Professor of Physical Chemistry, University of North Carolina, 1910-1913; Professor of Physical Chemistry, *ibid.*, 1913—

Clarence Ballew Hoke, B.S., Instructor in Chemistry.

B.S., University of North Carolina, 1913; Assistant, *ibid.*, 1911-1913; Teacher of Science, Winston-Salem High School, 1913-1915; Instructor in Chemistry, University of North Carolina, 1915.

Carnie Blake Carter, S.M., Assistant in Chemistry.

S.B., University of North Carolina, 1913; S.M., *ibid.*, 1914; Assistant, *ibid.*, 1912-1913, 1915-1916; Fellow in Technical Chemistry, *ibid.*, 1913-1194; Ledoux Fellow, *ibid.*, 1914-1916.

Victor Aldine Coulter, S.M., Assistant in Chemistry.

S.B., University of North Carolina, 1913; S.M., *ibid.*, 1914; Babbitt Scholar, 1912-1913; Fellow in Technical Chemistry, *ibid.*, 1914-1915; Ledoux Fellow, *ibid.*, 1915-1916.

Lucius Coleman Hall, Assistant in Chemistry.

Oscar Asa Pickett, Assistant in Chemistry.

Hal Burkhead Ingram, Assistant in Chemistry.

GRADUATE COURSES IN CHEMISTRY

RESEARCH

The University of North Carolina offers unusual advantages to students in the South who wish to extend their training in chemistry. After taking the ordinary undergraduate courses, students can best do this by devoting one, two or three years to research work in a well equipped laboratory. Four members of the chemical staff offer such work in a wide variety of subjects in inorganic, industrial, organic and physical chemistry. No adequate idea of the range of these subjects can be given in the limited space of this bulletin, but it may be said that more than one hundred and fifty articles have so far appeared in American and German chemical journals from the chemical laboratory of the University of North Carolina.

Any student who may come here for special study in chemistry will be pleased to discover the earnest spirit of work which prevails throughout the laboratory, the general interest in the various research problems and the good comradeship among the professors and students. As will be seen in the paragraph "Positions Filled," the laboratory trains men for the teaching professions and for a wide variety of industrial positions. At present there is not a sufficient supply of trained men to fill the positions which are open. There is a great industrial development going on at present in the United States and any young man who is interested in chemistry will be far better fitted to take a leading part in this development if he equips himself with the most thorough training. The general outlook for chemistry in this country was never so bright as it is now.

THE JOURNAL CLUB

The Journal Club is an organization of the teaching staff and students in chemistry. A meeting is held once every two weeks. At each meeting one member of the staff and several students present the outlines of important current articles appearing in the home and foreign chemical journals. An informal discussion follows each number on the program. In addition to this activity,

the club is now publishing a journal of its own, called the *Carolina Chemist.* Three issues will be published this year. It was established a year ago and is one of the first publications issued by a chemical laboratory.

SUMMER WORK

The laboratory is open throughout the year, except during the month of August. Research in the library and in the laboratory may be pursued during June and July, but no regular courses above the Freshman and Sophomore years are offered in the Summer School.

THE CHEMICAL LIBRARY

It is only with great difficulty that research can be carried on without immediate access to a good library. There is great risk to one's reputation and may be sheer waste of one's labors if dependence is laid upon a small library. The Chemical Library of the University of North Carolina is an unusually complete one and additions are constantly being made. It is, in fact, superior to many of the chemical libraries of the large universities of the United States and Europe. It is rarely that information on any point must be sought elsewhere. This is highly important to one in the midst of research, for otherwise the progress of the work might be blocked for as much as a month or even longer. This advantage cannot be too strongly emphasized. Fifty-seven journals are coming regularly to the library.

THE CHEMICAL LABORATORY

Chemistry Hall is located east of Alumni Hall. The main portion of the building is 120 feet long and 68 feet wide while to the rear extends the main lecture hall, 41 by 62 feet. The laboratories are lighted by electricity and are heated by hot water from the central power plant of the University. For electrochemical, experiments, for motors, and for stereopticon purposes electrical current is obtained both from the power plant and from a large storage battery.

In the halls of the main floor are numerous museum cases with specimens of typical chemicals, minerals and chemical products,

many of which have been presented to the department by commercial firms. Each laboratory is provided with fume closets for the removal of noxious gases. Following is a directory of the building:

Main Floor

Room 1.	Office of the Director.	Room 8.	General lecture room.
Room 2.	Private laboratory.	Room 9.	Private laboratory.
Room 3.	Departmental library.	Room 10.	Biological Chemistry.
Room 4.	Research laboratory.	Room 11.	Office.
Room 5.	Balance room.	Room 12.	Organic Chemistry.
Room 6.	Quantitative Analysis.	Room 13.	Private laboratory.
Room 7.	Private laboratory.		

Second Floor

Room 14.	Hydrogen Sulfide room.	Room 18.	Elementary Chemistry.
Room 15.	Qualitative and quantitative laboratory.	Room 19.	Balance room.
		Room 20.	Quantitative Analysis.
Room 16.	Qualitative laboratory	Room 21.	Private laboratory.
		Room 22.	Quantitative Analysis.
Room 17.	Lecture room.		

Basement

Room 23.	Storeroom A (with elevator to each floor).	Room 30.	Machine and tool room.
		Room 31.	Photochemistry.
Room 24.	Heavy chemical room.	Room 32.	Constant temperature room.
Room 25.	Storeroom B.		
Room 26.	Toilet room.	Room 33.	Assay room.
Room 27.	Research laboratory.	Room 34.	Gas machine and gas analysis room.
Room 28.	Fire-proof room.		
Room 29.	Physical Chemistry.	Room 35.	Lecture room.

POSITIONS FILLED

The work undertaken by men trained in the Department of Chemistry of the University of North Carolina is indicated below, the number of men being given in each field. The list includes very few of the men trained previously to 1900.

Teaching, 28; iron and steel, 33; agriculture, 25; commercial laboratories, 5; mining, 5; explosives, 5; fertilizer, 6; soda, 2; paint, 2; oil, 2; railroad laboratories, 2; rare earths, 1; tobacco, 1; Edison, 1; corn products, 1; tanning, 1; paper, 1; sugar, 1; carbide, 1; wine, 1; biological chemistry, 1. Total, 130.

EXPENSES

Graduates of the University of North Carolina and of other universities and colleges of good standing are ordinarily admitted to advanced courses free of charge for tuition. There is, however, a registration fee of $15 for each term, which includes the gymnasium fee, the library fee, the fee for the attendance of the University physician and the University nurse, and the fee for athletics. Each laboratory course has a small fee to cover the cost of materials used but not breakages.

Excellent board is furnished at Swain Hall for $12.50 a month. The University buildings contain rooms available for the accommodation of over 300 students. There is no extra charge for service. Room rent ranges from 75 cents to $6 a month for each occupant, the price depending on the location of the room. All rooms are heated by hot water and lighted by electricity. The charge for heat and light is $2 a month for each room.

Five students (graduate and senior) assist in the laboratory instruction work and six students (junior) act as storeroom keepers and give other necessary assistance. In this way part of the expenses may be earned while the student is gaining valuable experience in teaching and laboratory administration.

DEGREES

Graduates of the University of North Carolina and of other universities and colleges of good standing are, upon application to the President or Dean, ordinarily admitted to advanced courses of instruction. An applicant for admission, unless a graduate of the University of North Carolina, is required to present his diploma and a certificate of scholarship and character. If in any department the preliminary training of candidates has not been sufficient to qualify them for strictly graduate work, they will be required to take such undergraduate courses as may be prescribed by the head of the department; but these courses will not be counted for hours in work leading to a graduate degree.

Students who are not graduates may, if they prove themselves qualified, take graduate courses; but no graduate degree will be given a student who does not already hold a Bachelor's degree from some institution of approved standing.

Candidates for the degree of Master of Science must complete satisfactorily one year of study consisting of at least fifteen hours a week of recitations or lectures, eight hours of which must be taken from courses in the Graduate School, the remaining seven from courses in the Graduate School or from undergraduate courses open to Juniors and Seniors. The candidate must select one major subject, to which he shall devote at least half of his time, and one allied minor subject. He may, with the approval of the Dean and of the professor in charge of his major subject, select a second minor subject. He shall be required to have a reading knowledge of French and German in case the professor in charge of his major subject thinks it necessary for efficient work. The course as a whole must have unity and must be pursued with definite aim. A thesis based on the major subject of study and showing capacity for original research must be submitted on or before May 1 of the given year, and must be filed in typewritten form on or before May 15.

A candidate for the degree of Doctor of Philosophy is required to pursue, in residence at the University, a prescribed course of advanced study and research in one major subject and two allied minor subjects. In general, a term of three years is required, but the degree may be secured in two years in the case of exceptional preliminary training in the major subject.

These requirements of residence and study are, however, entirely secondary. The degree is conferred not simply for faithful study in a determinate field of work for a prescribed period, but because of a high attainment in a special branch of learning, which the candidate must manifest not only in examination, but by a thesis which gives evidence of independent research. The thesis must be accepted before the candidate may be admitted to examination. The examinations are both written and oral. They demand a minute knowledge of a special field of work as well as a general acquaintance with the department of learning in which the candidate offers himself for the degree. The candidate must also give proof of his ability to read French and German.

COURSES OF INSTRUCTION

Advanced Undergraduate Courses

18. History of Chemistry; Senior elective; prerequisite, Chemistry 61-62 and 81-82. *Spring term, two hours.* Professor VENABLE.

45-46. Technical Quantitative Analysis: laboratory work. Extension of course 41-42 along technical lines. Senior elective; prerequisite, Chemistry 41-42. *Both terms, two hours.* Professor HERTY.

Laboratory fee, $5.00 a term.

47-48. Gas Analysis, Assaying and Spectroscopic Analysis. Lectures and laboratory work. Senior elective; prerequisite Chemistry 41-42. *Both terms, one hour.* Professor BELL.

Laboratory fee, $2.50 a term.

48-49. Technical Quantitative Analysis: laboratory work. Extension of course 41-42 along technical lines; research. Senior elective; prerequisite, Chemistry 1-2, 31-32, and 41-42. *Both terms, five hours.* Professor HERTY.

Laboratory fee, $10.00 a term.

63-64. Organic Chemistry: laboratory work including analysis of (a) pure organic compounds, (b) food products, (c) commercial dye stuffs. Senior elective; prerequisite, Chemistry 61-62. *Both terms, two hours.* Professor WHEELER.

Laboratory fee, $6.00 a term.

83. Physical Chemistry: lectures and text-books, with laboratory work. Senior elective; prerequisite, Chemistry 81-82. *Fall term, three hours.* Professor BELL.

Laboratory fee, $2.50 a term.

84. Electro-Chemistry: theory and application of electricity to chemical processes. Senior elective; prerequisite, Chemistry 41-42. *Spring term, three hours.* Professor BELL.

Laboratory fee, $2.50 a term.

23-24. Research for Seniors. Required of Seniors in Course I; prerequisite, Chemistry 45-46, 47-48, 61-62, 81-82. *Both terms, five hours.* Professors HERTY, VENABLE, WHEELER, and BELL.

Laboratory fee, $12.50 a term.

11-12. Industrial Chemistry: the methods and economics of chemical industries, with special reference to those industries utilizing the products of the Southern States. *Both terms, three hours.* Professor HERTY.

13-14. Chemistry of Foods and Sanitation: composition of foods, their preservation, adulteration, and industrial production. Discussion of sanitation, disinfection, sewage disposal. *Both terms, two hours.* Professor VENABLE.

Graduate Courses

25-26. Advanced Inorganic Chemistry. Seminar course: readings and discussions of recent advances in inorganic chemistry. *Both terms, two hours.* Professor HERTY.

27-28. Research in Inorganic, Analytical, and Industrial Chemistry. This course (with 77-78 and 97-98) is intended only for applicants for the degree of Doctor of Philosophy or properly equipped students who desire special training in advanced chemical research. It requires, in addition to the laboratory work, daily conference with the professor and continual reference to the literature touching the matter under investigation. The work is usually assigned by the professor, but by special permission the student may elect to work upon problems to which he wishes to give particular attention. *Both terms, six hours.* Professors HERTY and VENABLE.

Laboratory fee, $15.00 a term.

75-76. Advanced Organic Chemistry: Seminar Course; readings and discussions; a study of class reactions with reference to their application to organic research is taken up, and special attention is given to the most important modern investigations. *Both terms, two hours.* Professor WHEELER.

77-78. Research in Organic Chemistry. The statements made in regard to course 27-28 apply also to this course. *Both terms, six hours.* Professor WHEELER.

Laboratory fee, $15.00 a term.

95-96. Advanced Physical Chemistry. Seminar Course; readings and discussions of recent advances in physical chemistry. *Both terms, two hours.* Professor Bell.

97-98. Research in Physical Chemistry. The statements made in regard to course 27-28 apply also to this course. *Both terms, six hours.* Professor Bell.

Laboratory fee, $15.00 a term.

IMPORTANT ALLIED SUBJECTS

The modern languages are of the highest importance in the study of chemistry. German, French, Italian and Spanish courses, even beginning courses, are offered in wide variety. A strong point is made of the spoken language. Physics, especially electricity, is also essential, and certain aspects of geology are important. A few of the many courses in these allied subjects are indicated below.

11-12. Practice in writing and speaking German. Prerequisite, German 1-2. Junior and Senior elective. *Both terms, two hours.* Associate Professor Brown.

25-26. Wide reading of modern German prose, with lectures on the literature in the nineteenth century. Junior and Senior elective; prerequisite, German 1-2. *Both terms, three hours.* Associate Professor Brown.

3-4. Advanced French: studies in reading and writing French. French phonetics. Junior and Senior elective; prerequisite, French 1-2. *Both terms, three hours.* Professor Dey.

1-2. Elementary Italian: grammar, pronunciation; oral and written exercises; translation and reading at sight. Junior and Senior elective; prerequisite, French 1-2. *Both terms, three hours.* Associate Professor Towles.

3-4. Second-Year Spanish. Direct Method continued. Wide reading of modern Spanish authors. Junior and Senior elective; prerequisite, Spanish 1-2. *Both terms, three hours.* Professor Dey.

3-4. Mineralogy: crystallography, physical and chemical properties of minerals, blowpipe analysis, determinations; lectures, laboratory, and field work; Dana's *Manual of Mineralogy* (Ford). Junior and Senior elective: prerequisite, Geology 1-2 and Chemistry 1-2. *Both terms, three hours.* Mr. SMITH.

42. Mineral and Ore Deposits: lectures supplemented by laboratory and field work; prerequisite, Geology 1-4 and Chemistry 31-32. *Twenty-four lectures (Spring term).* Professor PRATT.

5-6. Heat and Thermodynamics. Junior and Senior elective; prerequisite, Physics 1-2. *Both terms, two hours.* Professor PATTERSON.

7-8. Modern Electrical Theory: the electron theory, electrolysis, conduction of electricity through gases, electrical nature of matter, radioactivity; lectures and recitations. Junior and Senior elective; prerequisite, Physics 1-2. *Both terms, two hours.* Professor PATTERSON.

9-10. Generation, Transmission and Utilization of Electrical Energy. This course is designed primarily for students of Chemical and Civil Engineering, and others who desire to obtain a general practical knowledge of electrical apparatus, including direct and alternating current dynamos, transformers, motor starters and controllers, storage-batteries, and incandescent and arc lamps. Text: Gray's *Principles and Practice of Electrical Engineering.* Lectures, recitations and laboratory work. Required of Seniors in Courses I and III. Prerequisite, Mathematics 3-4, and Physics 1-2. *Both terms, three hours.* Mr. STAPLES.

21. Electric Measuring Instruments: a study of the theory, construction and methods of use of the various instruments used in electric measurements and testing. Considerable attention is given to the errors involved in measurements. Text: Jansky's *Electrical Meters.* Senior elective. Prerequisites, E. E. 11-12. *Fall term, three hours.* Professor DAGGETT.