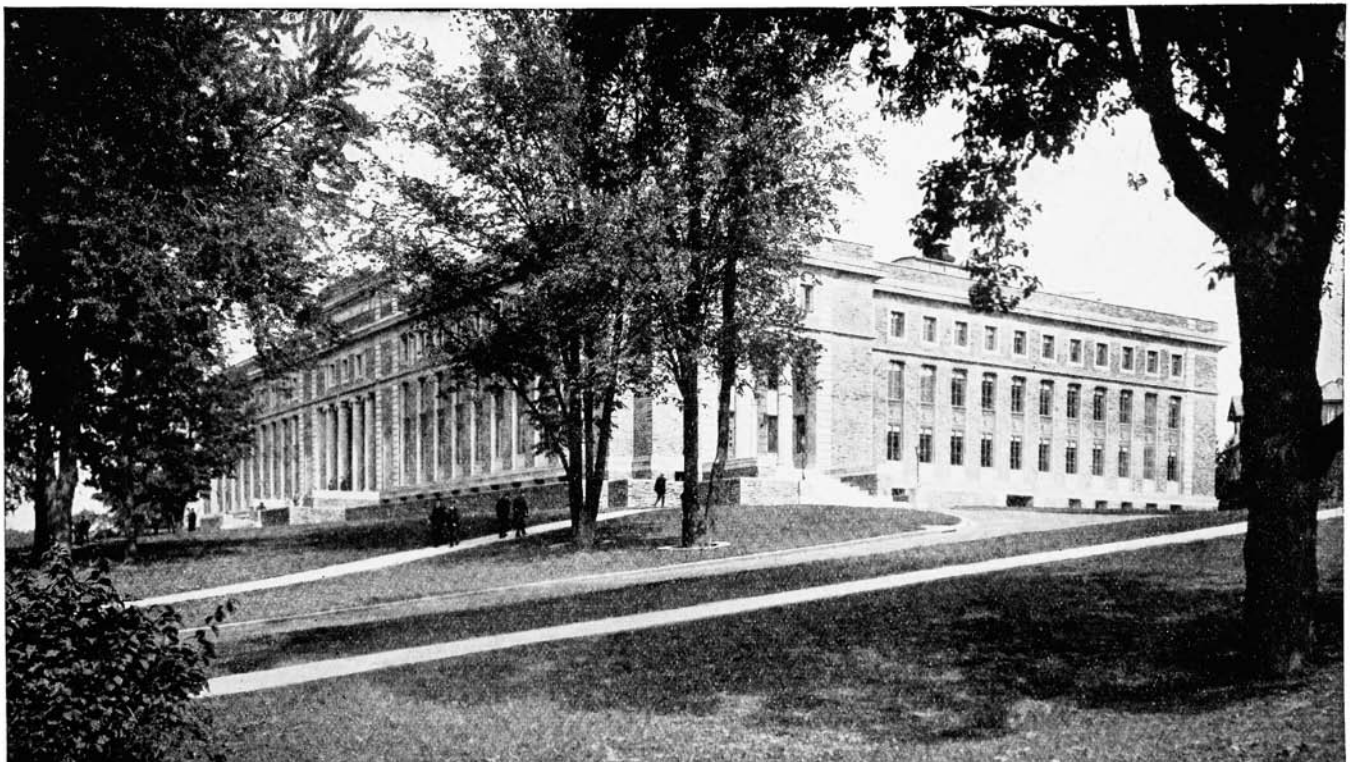
CORNELL UNIVERSITY
OFFICIAL PUBLICATION

Volume XXV Number 15

The College of Arts and Sciences

Announcement of the Department of Chemistry for 1934-35

Ithaca, New York
Published by the University
March 15, 1934



THE BAKER LABORATORY OF CHEMISTRY

DEPARTMENT OF CHEMISTRY

STAFF OF INSTRUCTION

JACOB PAPISH, Ph.D., Acting Head of the Department, and Professor of Chemical Spectroscopy.
LOUIS MUNROE DENNIS, D.Sc., Professor of Inorganic Chemistry, Emeritus.
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EMILE MONNIN CHAMOT, Ph.D., Professor of Chemical Microscopy and Sanitary Chemistry.
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FRED HOFFMAN RHODES, Ph.D., Professor of Industrial Chemistry.
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ALBERT WASHINGTON LAUBENGAYER, Ph.D., Assistant Professor of Inorganic Chemistry.
CHARLES WALTER MORSE, Ph.D., Instructor in Analytical Chemistry.
RALPH COLTON TALLMAN, Ph.D., Instructor in Organic Chemistry.
ALFRED WILLIAM AVENS, B.S., M.S., Instructor in Analytical Chemistry.
RALPH ALEXANDER CONNOR, Ph.D., Instructor in Organic Chemistry.

ASSISTANTS IN CHEMISTRY, 1933–34

AMSTUTZ, EDWARD DELBERT, B.S., M.S.
BAKER, MAURICE OLIVER, A.B., Ph.D
BATY, JOSEPH ALONZO, B.A.
BETTEN, CORNELIUS, JR., A.B.
BRANT, JOSEPH HENRY, A.B.
BROWNE, ARTHUR WESTGATE, A.B.
BUSH, MILTON TOMLINSON, B.Chem.
CAMPBELL, HERBERT NOEL, B.S., M.S.
CARR, RALPH LEONARD, B.S.
CONGDON, WILLIAM JANES, B.Chem.
DAVIDSON, HARRY STONE, B.S.
ELLIOTT, PAUL MARSHALL, B.S.
ENGLE, ROBERT FRY, B.S., M.S.
FERGUSON, ROBERT PAUL, A.B.
FORGENG, WILLIAM DANIEL, B.Chem., Ph.D.
GEIGLE, WILLIAM FREDERICK, B. Chem.
GOULD, LAWRENCE PEABODY, B.Chem. Ph.D.
GROSS, PETER FREDERICK, A.B., M.S.
HARRISON, HAROLD CHARLES, B.S.
HAYWARD, FREDERICK WARREN, B.S. M.S.
HOUPT, ALFRED GORDON, B.Chem.
HUGHES, EDWARD WESLEY, B.Chem.
JACOBS, TOM LLOYD, A.B.
JONES, FRANCIS TUCKER, A.B., M.A.
LUDDEN, FREDERICK COLEMAN, A.B.
MAGOFFIN, JAMES EDWARD, B.Chem.
MAY, GEORGE EARL, A.B.
MURPHY, NELSON FRANCIS, Ch.E.
NORTON LELAND BERNARD, B.S.
O'LEARY, WILLIAM JOSEPH, A.B., M.A., Ph.D.
RAMSAY, JAMES WILSON, B.S., A.M.
ROCHOW, THEODORE GEORGE, B.Chem.
ROSEVEAR, FRANCIS BURT, A.B.
SCHOFIELD, FRANK MCGREW, B.S., M.S.
SHELTON, ROBERT SCHEMBER, A.B.
SHERK, KENNETH WAYNE, A.B., Ph.D.
SLACHMAN, PRESTON GERAULD, B. Chem.
SNYDER, HAROLD RAY, B.S.
STEVENSON, HALSEY BIDWELL, B. Chem.
VAN CAMPEN, MARCUS GEORGE, B.S.
WAINER, EUGENE, B.S., Ph.D.
WALLACE, EDWARD HAMILTON, B.S.
WANNAMAKER, THOMAS ELLIOTT, B.S.
WYNN, CLAYTON SCOTT, A.B.
YOUNGER, KENNETH RICHARD, B. Chem., M.Chem.

FELLOWS AND SCHOLARS IN CHEMISTRY, 1933–34

The Sage Fellowship: LEE GEORGE DAVY, A.B.
The Graduate Scholarship: LEE GEORGE DAVY, A.B.

NON-RESIDENT LECTURESHIP

The George Fisher Baker Non-Resident Lectureship in Chemistry at Cornell University was established early in the year 1926 by a gift from Mr. Baker, the income to be used by the University for the benefit and advancement of teaching and research in Chemistry and allied sciences. Under this plan the University invites eminent men of science to come to Cornell to present the most recent advances, and the methods and results of their own investigations, in the fields in which they have won distinction.

The Non-Resident Lecturers under the George Fisher Baker Foundation deliver two lectures a week, and hold a colloquium. In some cases they also conduct experimental research with a few advanced students. The lecturers thus far have been:

Ernst Cohen, Professor of Physical and Inorganic Chemistry, University of Utrecht, Holland. *Second term, 1925–26.*

Fritz Paneth, Professor of Inorganic Chemistry, University of Berlin, Germany. *First term, 1926–27.*

A. V. Hill, Foulerton Research Professor of the Royal Society of London, England. *Second term, 1926–27.*

Paul Walden, Professor of Chemistry, University of Rostock, Germany. *First term, 1927–28.*

George Barger, Professor of Chemistry in its Relations to Medicine, University of Edinburgh, Scotland. *Second term, 1927–28.*

Hans Pringsheim, Professor of Chemistry, University of Berlin, Germany. *First term, 1928–29.*

F. M. Jaeger, Professor of Physical and Inorganic Chemistry, University of Groningen, Holland. *Second term, 1928–29.*

G. P. Thomson, Professor of Natural Philosophy, University of Aberdeen, Scotland. *First term, 1929–30.*

K. Fajans, Professor of Physical Chemistry, University of Munich, Germany. *Second term, 1929–30.*

G. Hevesy, Professor of Physical Chemistry, University of Freiburg in Baden, Germany. *First term, 1930–31.*

N. V. Sidgwick, Fellow and Tutor in Chemistry, Lincoln College, Oxford, England. *Second term, 1930–31.*

C. H. Desch, Professor of Metallurgy, University of Sheffield, England. *First term, 1931–32.*

Alfred Stock, Director of the Chemical Institute, Technische Hochschule, Karlsruhe, Germany. *Second term, 1931–32.*

Otto Hahn, Director of the Kaiser Wilhelm Institut für Chemie, Berlin-Dahlem, Germany. *Second term, 1932–33.*

W. L. Bragg, Professor of Physics, University of Manchester, England. *Second Term,* 1933–34.

The program of these lectures through 1934–35 is as follows:

SUMMER, 1934

Professor G. N. LEWIS, University of California.
Topic of Lectures: Isotopes.

FIRST TERM, 1934–35

Professor J. R. KATZ, University of Amsterdam, Holland.
Topic of Lectures: The Study of Substances of High Molecular Weight by means of X-rays.

SECOND TERM, 1934–35

Professor FARRINGTON DANIELS, University of Wisconsin.
Topic of Lectures: Chemical Kinetics.

ASSISTANTSHIPS AND FELLOWSHIPS

A number of Teaching Assistantships, (which are really working fellowships) are open to graduate students majoring in Chemistry. Applications for these positions should be filed with the Department before March 1.

Assistants receive three-fourths residence credit for graduate work carried on during the period of their appointment. By an additional eight weeks of study in the summer, a full year's residence credit may be earned.

Fellowships and Scholarships are ordinarily awarded to students who have had at least a year of graduate study. Applications for them should be filed before March 15.

THE CALDWELL PRIZE

An annual prize of fifty dollars was established by Grace Caldwell Chamberlain and Francis Cary Caldwell in memory of their father, George Chapman Caldwell, Professor in the Department of Chemistry from 1867 to 1902, and Head of the Department until 1902. It is awarded by the Staff of the Department to a member of the Senior class in recognition of general excellence in chemistry. The prize was awarded in 1933 to George Keating Smith Connolly. The previous winners were: 1914, A. Bridgman; 1915, F. R. Georgia; 1916, C. G. Stupp; 1917, B. H. Carroll; 1918, M. L. Nichols; 1919, L. H. Clark; 1920, A. C. Wintringham and M. P. Woodward; 1921, H. F. Vieweg; 1922, R. E. Burk; 1923, E. L. Arnold; 1924, T. Parsons, jr.; 1925, H. A. Lovenberg; 1926, R. M. Herbst; 1927, Miss Florence Bush; 1928, M. Benedict; 1929, L. P. Gould; 1930, F. W. Schumacher; 1931, E. G. Rochow; 1932, K. H. Ferber.

THE LOVENBERG MEMORIAL PRIZE

An annual prize of fifty dollars was established by Mr. and Mrs. O. F. Lovenberg in memory of their son Harold Adlard Lovenberg, B.Chem., 1925. It is awarded on the basis of an examination held in May, to a member of the senior class in the Course in Chemistry. The examination, set by the Department of Chemistry, is to be of such nature as to test not only the student's general acquaintance with chemistry, but also the breadth and accuracy of his general information.

The prize was awarded in 1933 to Halsey Bidwell Stevenson.

The previous winners were: E. G. Rochow, 1931; K. H. Ferber, 1932.

COLLEGE OF ARTS AND SCIENCES

The requirements for entrance to the courses leading to the degrees of Bachelor of Arts, Bachelor of Chemistry, or Chemical Engineer, together with information concerning tuition, fees, living expenses, scholarships, prizes, financial assistance, and opportunities for self-support, will be found in the General Information Number, which may be obtained from the Secretary of the University.

REQUIREMENTS FOR THE A.B. DEGREE WITH MAJOR IN CHEMISTRY

Courses in Chemistry

*Inorganic Chemistry 101 and 105; or 110 and 115.
*Qualitative Analysis 205 and 206; or 210; or 203.
*Quantitative Analysis 220 and 221; or 225.
Organic Chemistry 305.
Organic Chemistry Laboratory 310 (first term).
Physical Chemistry 405.
Physical Chemistry Laboratory 410 (one term).
Electives in Chemistry, 6 hours.

Courses in Related Subjects

Physics 3 and 4; German 1 or 1a, or two years of German for entrance.

Twelve additional hours in related subjects, to be selected from the following: Astronomy 180 and 181; Bacteriology 1, 43, 43a; Biochemistry 314; Biology A; Animal Biology 1; Botany 1; Geology A, 100, 311; Mathematics (the completion of courses up to and including Analytic Geometry and Calculus is recommended); Physics, any course; other courses subject to the approval of the Department of Chemistry.

It is recommended that the additional free elective hours required for graduation be chosen from fields of study other than the sciences.

THE COURSES IN CHEMISTRY

The Department of Chemistry offers a four-year course leading to the degree of Bachelor of Chemistry. Graduates who have fulfilled the requirements for this degree, or the substantial equivalent thereof, may obtain either the degree of Master of Chemistry or the degree of Chemical Engineer by completing satisfactorily one additional year of study. The additional year of residence required for either of these degrees may, upon recommendation of the student's special committee, be accepted as satisfying one year of the residence requirement for the degree of Doctor of Philosophy. The four-year course leading to the degree of Bachelor of Chemistry is not a prerequisite for the degrees of Master of Arts, Master of Science, or Doctor of Philosophy with major subject in Chemistry.

THE DEGREE OF BACHELOR OF CHEMISTRY

The degree of Bachelor of Chemistry will be awarded to those who have satisfactorily completed either of the following curricula, and the requirements prescribed by the University in Hygiene and Preventive Medicine and in Military Drill or in Physical Training. The completion of Curriculum No. 2, or its substantial equivalent, is required for admission to the fifth year of study leading to the degree of Chemical Engineer (see page 9). Since the first two years of work are identical in the two curricula, the student is afforded ample time to discover whether his interests lie chiefly in the field of pure chemistry or in the field of chemical engineering before he is compelled to decide upon his further course of study.

CURRICULUM NO. 1

First Year		*Course*	*First Term*	*Second Term*
Introductory Inorganic Chemistry	Chemistry	110	3	2
Inorganic Chemistry Laboratory	Chemistry	115	3	—
Introductory Qualitative Analysis	Chemistry	203	—	5
Analytic Geometry and Calculus	Mathematics	5a, 5b	5	5
English 1	English	1	3	3
Introductory Experimental Physics	Physics	11, 12	4	4
			18	19
Second Year				
Introductory Organic Chemistry	Chemistry	305	3	3
Organic Chemistry Laboratory	Chemistry	310	3	3
Introductory Quantitative Analysis	Chemistry	220	3	—
Quantitative Analysis Laboratory	Chemistry	221	3	—
Gas and Fuel Analysis	Chemistry	250	—	3
General Physics	Physics	21, 22	3	3
German	German	1a	3	3
Drawing	Engineering	125	—	3
			18	18
Third Year				
Introductory Physical Chemistry	Chemistry	405	3	3
Physical Chemistry Laboratory	Chemistry	410	3	3
Advanced Inorganic Chemistry	Chemistry	130	3	3
Introductory Chemical Spectroscopy	Chemistry	505	3	—
Introductory Chemical Microscopy	Chemistry	530	—	3
Advanced Quantitative Analysis	Chemistry	230	—	3
Elementary Mineralogy	Geology	311	3	—
Electives	(at least)		2	2
			17	17
Fourth Year				
Introductory Industrial Chemistry	Chemistry	705	3	3
Chemical Engineering	Chemistry	710	—	4
Special Topics in Physical Chemistry	Chemistry	420	3	—
Special Topics in Chemistry	Chemistry	910	—	1
Introduction to Economics	Economics	3	3	—
Electives			8	9
			17	17

CURRICULUM NO. 2

(This curriculum is prerequisite to the degree of Chemical Engineer)

FIRST AND SECOND YEARS

As in Curriculum No. 1

THIRD YEAR

		Course	*First Term*	*Second Term*
Introductory Physical Chemistry	Chemistry	405	3	3
Physical Chemistry Laboratory	Chemistry	410	3	3
Introductory Chemical Microscopy	Chemistry	530	—	3
Elementary Mineralogy	Geology	311	3	—
Mechanics	Engineering	3M21	5	—
Strength of Materials	Engineering	3M22	—	3
Hydraulics	Engineering	3M23	—	2
Materials of Construction	Engineering	3X21	3	—
Materials of Construction	Engineering	3X22	—	3
			17	17

FOURTH YEAR

Introductory Industrial Chemistry	Chemistry	705	3	3
Advanced Inorganic Chemistry	Chemistry	130	3	3
Special Topics in Physical Chemistry	Chemistry	420	3	—
Introductory Chemical Spectroscopy	Chemistry	505	—	3
Special Topics in Chemistry	Chemistry	910	—	1
Advanced Quantitative Analysis	Chemistry	230	3	—
Heat Power Engineering	Engineering	3P33	3	—
Heat Power Engineering	Engineering	3P34	—	3
Mechanical Laboratory	Engineering	3X33	3	—
Mechanical Laboratory	Engineering	3X32	—	3
			18	16

The elective courses required in the curriculum may be chosen by the student, in each case with the approval of his adviser, from the advanced courses in Chemistry, or from courses in other departments of the College of Arts and Sciences, or in other colleges of the University.

Students in the Courses in Chemistry may not register for more than 19 hours a term (not including Hygiene) without first securing the consent of the Department.

A student who does not pass at least twelve hours in any term, with a grade of C or better in at least six of the twelve hours, may be dropped from the University or placed upon probation. The same penalty may be imposed upon students in the Summer Session, who do not pass four hours, with a grade of C or better in at least two hours.

If, in the opinion of the Staff of the Department of Chemistry, a student's general record is unsatisfactory the Staff may recommend that he be refused permission to continue as a candidate for the degree of Bachelor of Chemistry, even though he has passed twelve hours or more in the preceding term. In general, a scholastic record which does not show the completion of at least twelve hours a term of the prescribed studies and a grade of C or better in at least half of the hours in Chemistry, will not be considered satisfactory.

Students in the Courses in Chemistry who receive a grade of "E" may remove it by examination or other requirement set by the Department.

The degree of Bachelor of Chemistry, granted upon completion of the four-year course of study just outlined, has a significance that is in some respects unique, and, in so far as a degree may do so, represents a distinctive type of training which its holders have under-

gone. Although for many years a certain sequence of courses has been required of all students majoring in chemistry, the present degree originated only after careful consideration and trial of its prerequisites. Since 1910, when it was first announced, the course in chemistry has been tested in the classroom as well as by more than four hundred alumni, and modifications in its curriculum have been made in the light of the development of the science and the demands of industry.

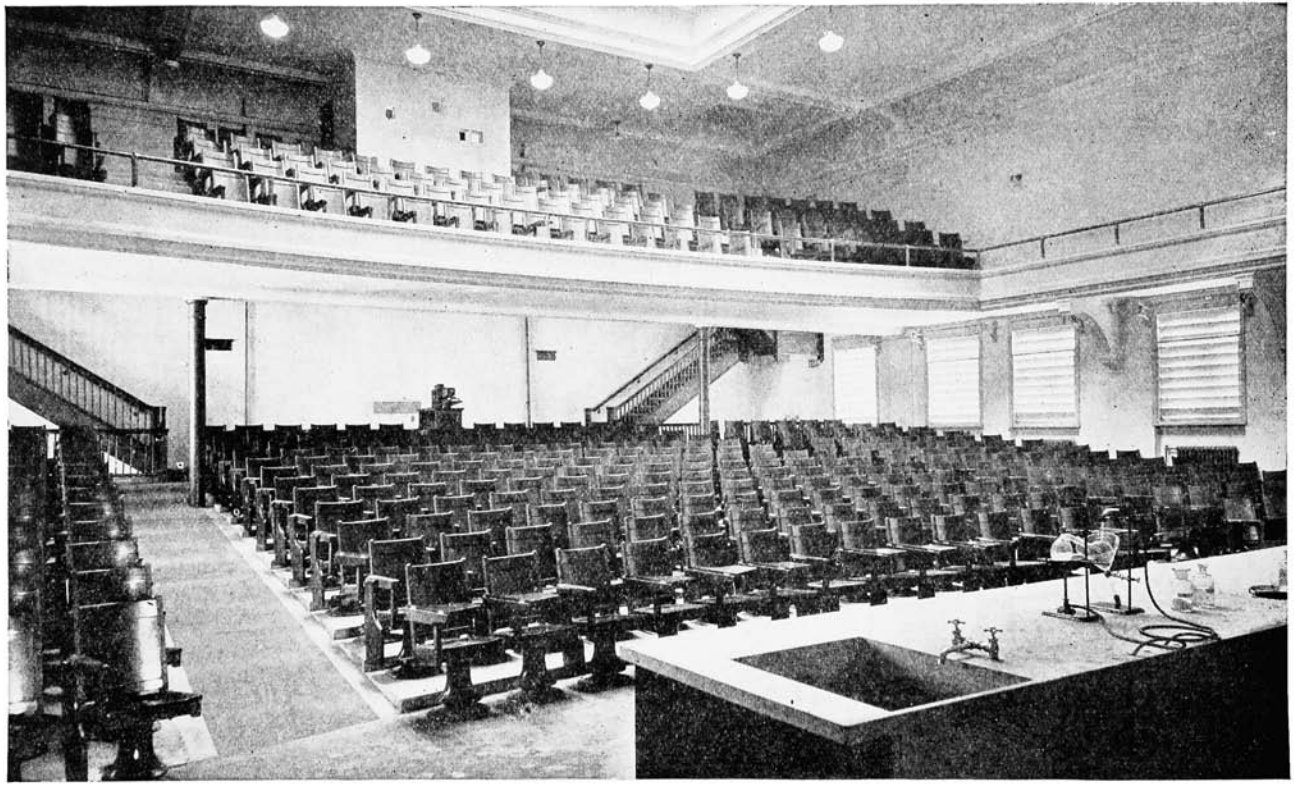
The large majority of Bachelors of Chemistry go into some field of industrial work, and the course in chemistry is planned to give them the training necessary for positions either in the research laboratory or in the plant. This preparation is primarily in the fundamental divisions of chemical science; it moreover includes instruction in special branches designed to acquaint the student with the best modern methods of attacking the various problems that may arise in the future practice of his profession. In the curriculum for this degree, some instruction in engineering subjects is included so that the student may become acquainted with the methods and point of view of the engineer.

THE DEGREE OF CHEMICAL ENGINEER

A holder of the degree of Bachelor of Chemistry who has completed Curriculum No. 2, as given above, may obtain the degree of Chemical Engineer by completing a fifth year of study offered jointly by the College of Engineering and the Department of Chemistry of the College of Arts and Sciences. The curriculum for this fifth year leading to the degree of Chemical Engineer is as follows:

		Course	*First Term*	*Second Term*
Electrical Engineering Lectures	Engineering	405	4	—
Electrical Engineering Lectures	Engineering	406	—	4
Machine Design	Engineering	3D34	2	—
Machine Design	Engineering	3D36	1	—
Mechanical Engineering Laboratory	Engineering	3X43	2	—
Industrial Organization	Engineering	3I31	2	—
Chemical Engineering	Chemistry	710	—	4
Chemical Plant Design	Chemistry	730	3	3
Introduction to Economics	Economics	3	—	3
Electives			3	3
			17	17

The course of study leading to the degree of Chemical Engineer is intended primarily to prepare the graduate for technical work involving the development and supervision of the operation of industrial chemical processes and plants. It comprises instruction not only in the theoretical principles of chemistry and engineering, but also in the methods of applying these principles to the solution of the problems that arise in the industries.



MAIN LECTURE ROOM

Choice of Electives

Although the Courses in Chemistry and in Chemical Engineering are rather highly specialized, they include a sufficiently large portion of electives to enable the student to broaden his education by taking courses in Literature, Public Speaking, Education, Psychology, Philosophy, History, Economics, and other humanistic studies, or to pursue intensive study in pure or applied science.

The first three years of the university work of a candidate for the degree of Bachelor of Chemistry are devoted to training in fundamental theories, applications, and methods, of chemistry and of allied sciences. By the fourth year the student should have some idea as to the field of chemistry which is most attractive to him, and should be looking ahead toward his career after graduation. It is eminently desirable that the choice of electives should be made after such consideration, and the student is advised to consult with his class adviser during the junior and senior years in order that this may represent a certain continuity of purpose.

Where electives are included in the sophomore or junior years these should be selected so as to insure adequate preparation for any specialized study in the senior year. The elective hours of the senior year may be devoted to courses in the "humanities," or in allied sciences such as Physics, Geology, Botany, and Biology, or to advanced courses or research in Chemistry. By a proper choice of electives, the student who wishes to secure a more extensive training than is offered in the Courses in Chemistry may extend his studies over five years, interspersing additional elective courses throughout this period. Such a five-year course is particularly recommended for students desiring a broadly cultural training in addition to their specialized work in Chemistry.

OPPORTUNITIES FOR EMPLOYMENT AFTER GRADUATION

The student's occupation as a chemist after graduation is likely to fall into one of the following classes:

Inspection and control, in industrial, institutional, or government laboratories,

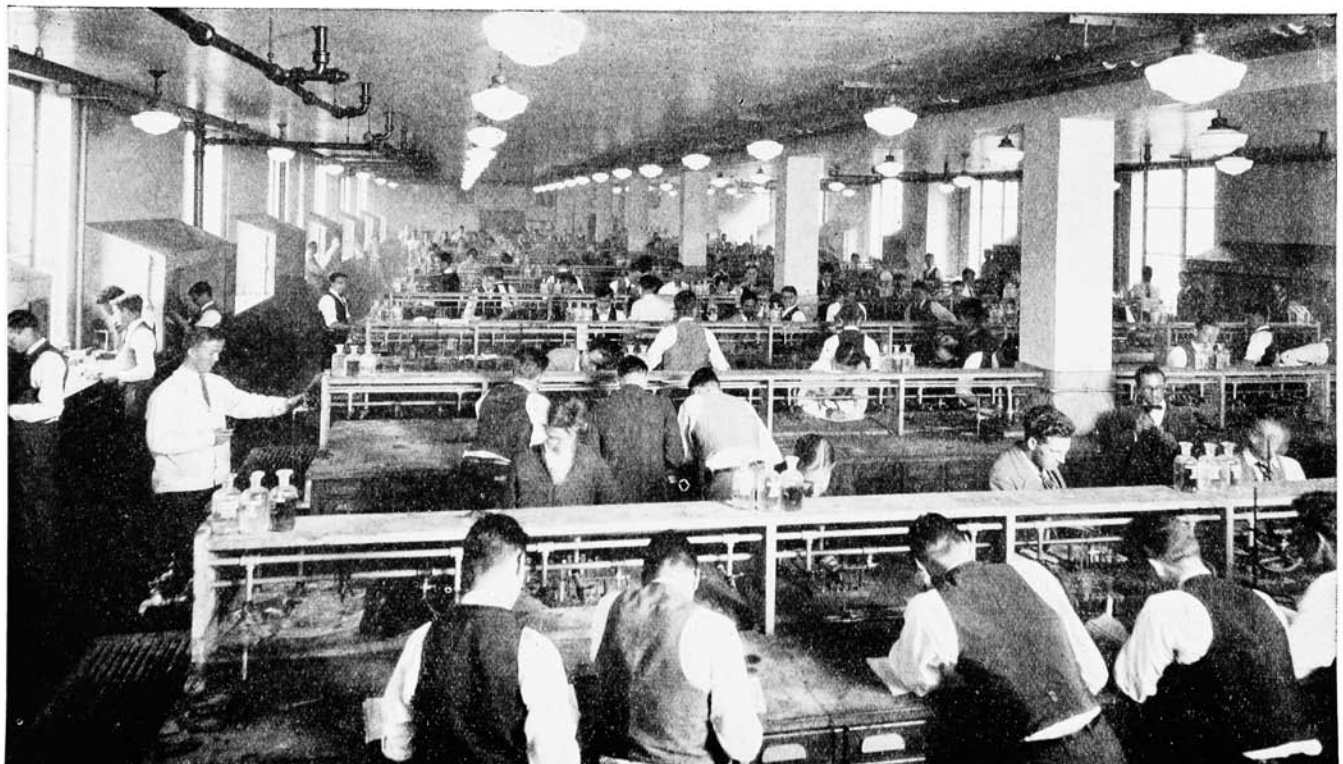
Supervision of operation in chemical plants,

Research and development,

Technical sales or technical purchasing,

Teaching.

A committee on Employment has charge of finding suitable positions in the above fields.



LABORATORY OF INTRODUCTORY INORGANIC CHEMISTRY

GRADUATE WORK IN CHEMISTRY

In any of the possible careers mentioned above, the scientific and economic position of a chemist is greatly advanced by post-graduate training. In research or plant work the holders of advanced degrees are given preferment, while for teaching positions in institutions of collegiate rank the doctor's degree is usually prerequisite. In order that this degree may have a uniform significance, graduates of other universities are required to present the substantial equivalent of the chemical training included in the Courses in Chemistry, (see p. 7) or to complete this during their graduate study at Cornell. Such prerequisite courses should be taken during the first half of the candidate's period of residence, and together with the minor subjects, should give him a sound foundation for the major research problem which will occupy the greater part of his last two years of residence.

REQUIREMENTS FOR GRADUATE STUDY

The Announcement of the Graduate School gives information regarding the general requirements for admission to the Graduate School, and for study toward advanced degrees; the following paragraphs are to be considered as supplementing but in no way superseding these requirements.

Entering students must consult the chairman of the Graduate Scholarship Committee of the Department of Chemistry, before registering.

All graduate students in chemistry are required to register at the Record Office of the Department of Chemistry, on the registration days at the beginning of each term of residence, and to file at this office, as well as at the office of the Graduate School, all records of changes in registration, or in major and minor subjects, of completion of language requirements, and of the passing of qualifying or general examinations.

Graduate students are expected to take the examinations in all courses taken in their major and minor fields of Chemistry.

MAJOR IN CHEMISTRY

Entrance Requirements

Candidates for the degree of Master of Arts, Master of Science, or Doctor of Philosophy, with major in Chemistry will be required to offer for admission the equivalent of Introductory Inorganic Chemistry 101 and 105; Qualitative Analysis 205 and 206, or 210; Quantitative Analysis 220 and 221, or 225; Introductory Organic Chemistry 305, and 310 (one term); Introductory Physical Chemistry 405, and 410 (one term); they must also present the equivalent of two units of German.

Candidates for the degree of Master of Chemistry must present the full equivalent of the requirements for the degree of Bachelor of Chemistry at Cornell University.

Minors

For a Master's degree one, and for a Doctor's degree two minor subjects, chosen from the Divisions of the Department, or from other Departments, are re-

quired. The candidate is expected to acquire a general knowledge of the fundamental topics (subjects, achievements) in the field of each Minor and an acquaintance with the history of the chief discoveries and generalizations in that field.

The candidate is at liberty to secure this information by lectures, by laboratory courses or by reading, as he may prefer, except that the Member of the Staff in charge of the Minor may require the successful completion of lecture and laboratory courses amounting to not more than six credit hours in all.

If the candidate has acquired the above general knowledge by courses taken before entering upon his graduate work in this Department, he will be assigned advanced reading in the field of the Minor as a means of fulfilling its requirement.

DOCTOR OF PHILOSOPHY

Attention is called to the fact that the additional year of residence required for either the degree of Master of Chemistry or for that of Chemical Engineer at Cornell University may, upon recommendation of the student's special committee, be accepted as satisfying one year of the residence requirement for the degree of Doctor of Philosophy with major subject in Chemistry.

Candidates for the degree of Doctor of Philosophy with major in Chemistry must have completed, before the beginning of the last year of residence, the equivalent of Advanced Quantitative Analysis 230, Gas and Fuel Analysis 250, Introductory Physical Chemistry Laboratory 310 (second term), Introductory Chemical Spectroscopy 505, and Introductory Chemical Microscopy 530.

Every candidate for the Doctor's degree is required to pass a Qualifying Examination before he is allowed to begin actual experimental work on his thesis problem. This examination will comprise tests in the following four Divisions of Chemistry: (A) Inorganic and General; (B) Analytical; (C) Organic, and (D) Physical. The individual tests, each consisting of a written examination covering a period of two or three hours, will be given in succession at intervals of one week.

One such Qualifying Examination is given at the beginning of each regular term, and at the end of the second regular term of the University year, on days set by the Committee on Qualifying Examinations. The candidate should present himself for the Qualifying Examination not later than the beginning of the term in which he expects to begin actual laboratory work on his thesis problem. In the light of the candidate's achievement in this examination, his Special Committee may further examine his qualifications for graduate study.

Failure of the candidate to pass any one of the four tests with a minimum grade of 60 will entail repetition of that particular test; failure in this second trial, or failure to pass two or more of the tests with a minimum grade of 60 will necessitate repetition of the entire Qualifying Examination. Any candidate who fails to pass all four parts of the Qualifying Examination on this final trial will not be allowed to complete the requirements for the degree of Doctor of Philosophy.

After the candidate has passed the Qualifying Examination, and has completed his minor subjects, he will be required to pass a general examination, both written and oral, on his major and minor subjects. Upon recommendation of the candidate's Special Committee, this examination may be taken toward the end of the term preceding his last year of residence. This procedure makes it possible for the candidate to devote his last year of residence to uninterrupted research on his thesis. At the close of his period of residence, and after the acceptance of his thesis the candidate will be required to pass a final oral examination on the thesis and on related subjects.

As an alternative procedure, the general examination on major and minor subjects and on the thesis may be taken after the acceptance of the thesis.

MINOR IN CHEMISTRY, MAJOR OUTSIDE OF CHEMISTRY

The following courses, or their equivalent, are prerequisite: Introductory Inorganic Chemistry 101 and 105. Qualitative Analysis 210, Quantitative Analysis 225.

The candidate shall have such a knowledge of the minor subject as could be acquired by six credit hours of work in the field.

THE BAKER LABORATORY OF CHEMISTRY

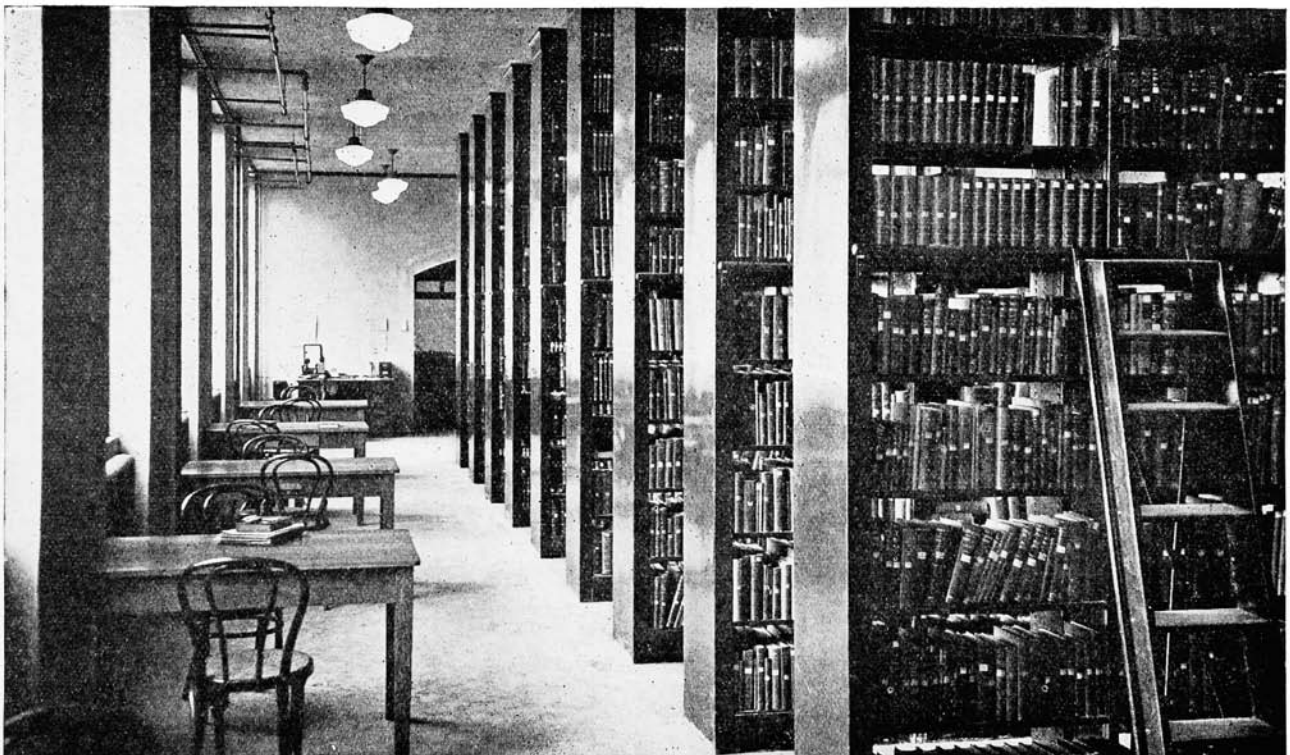
The general equipment of the laboratory and the administration of its various facilities are planned to give the maximum opportunity for unhampered work in the various fields of chemistry. Materials may be subjected to temperatures ranging from those of the electric furnace to that of liquid air, to extreme pressures or high vacua, to electrolysis or to the action of various radiations; they may be studied microscopically, spectroscopically, or by means of x-rays, and the production may be carried out under the exacting conditions of research or in semi-plant scale apparatus. The aim has been to enable chemical behavior to be studied under the widest possible variety of conditions, and by all the different methods used by chemists. On the instructional side, these special methods are available for the demonstration of the whole range of properties of chemical substances, and for the training of students in their observation and interpretation.

The building in which the Department of Chemistry is housed was given to the University by George Fisher Baker. The close co-operation between the Staff of the Department and the architects and engineers engaged in its construction is responsible for scope and facilities hardly to be surpassed. Some four acres of floor space are available for purposes of instruction, which is given to over 2,000 students every year; the number of registrations in Chemistry courses exceeds 4,000 annually. Exceptionally complete administrative and engineering equipment takes up an additional acre of floor space.

Each of the Divisions of the Department occupies a group of rooms, adjacent to the offices of the instructors in charge, and provided with special plumbing and electric current as required. Distilled water, steam, circulating hot water, cold water, gas and compressed air are supplied to all lecture rooms and laboratories, the last three being supplied to all individual desks. A motor generator set in the basement furnishes direct current of constant potential, 55 or 110 volts, by means of a three-wire system, to all the advanced laboratories. A number of these are also connected with a storage battery current for lower voltages. A second motor generator set having a capacity of 2,000 amperes, D.C. or A.C., supplies the heavy currents necessary for electric furnace work, and a special high frequency converter is used in connection with an Ajax-Northrup induction furnace.

The building is ventilated by two separate sets of electrically driven fans which are located in the attic. One set supplies fresh air to all rooms, while the other exhausts air from the hoods in the various laboratories. These hoods are of the open front type, and each is vented to the exhaust flue at the top and bottom of a "baffle-plate" at the back.

The laboratory table tops, sinks, hoods and much of the shelving in the building are of alberene stone.



LIBRARY STACK ROOM WITH READING ROOM BEYOND

The main stock rooms are located in the basement, and are connected by elevators with the eight dispensing stock rooms which serve the various laboratories.

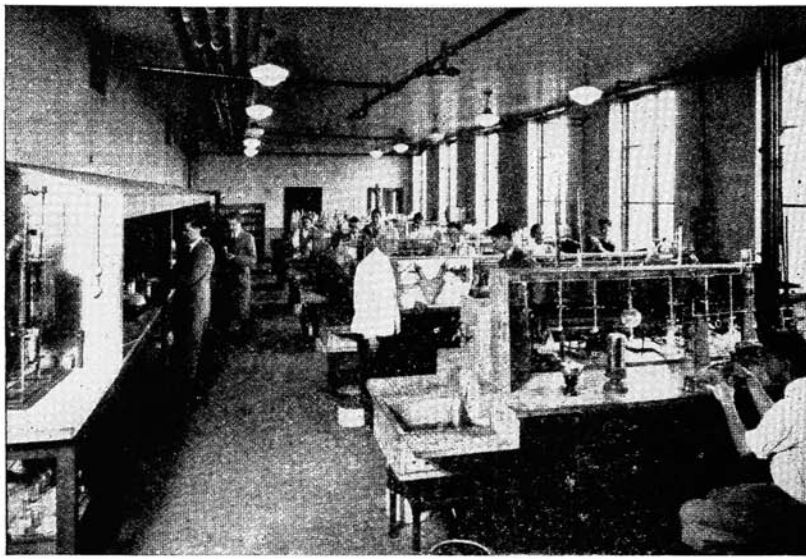
A mechanician, in charge of a completely equipped shop, is available for the construction of special apparatus. An equipment for the production of liquid air, owned jointly with the Department of Physics and housed in the neighboring Laboratory of Physics, Rockefeller Hall, is of such capacity as to furnish an abundant supply of liquid air for lecture demonstrations and investigational purposes.

A locker room with showers, men's and women's rooms, and numerous coat rooms are provided for the convenience of the students and a first aid room is equipped to care for minor accidents.

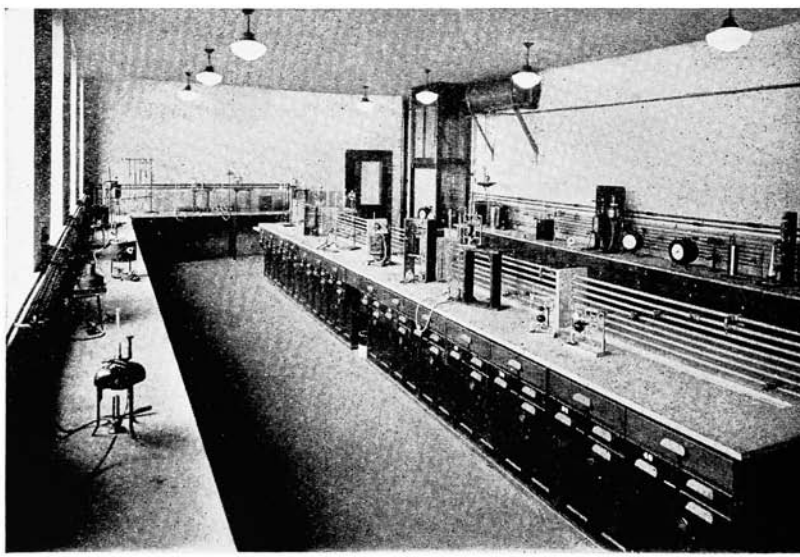
The main lecture room, seating 476, is so arranged, that all the seats are within 55 feet of the lecture table. It is equipped with rapid-acting shutters, so that it may conveniently be darkened for showing slides or motion pictures. Five other lecture rooms, all containing projection lanterns, communicate through their preparation rooms by electric elevators with the museum. A number of recitation rooms are also provided.

The Museum, through which the main lecture room is reached, is part of the working equipment of the Department and is used as a repository for much of the illustrative material used in the various courses. It contains, in addition to specimens of synthetic and naturally occurring chemical substances, an extensive collection of raw materials and finished products of industries exemplifying the more important commercial chemical processes.

The Department Library is very fully supplied with works of reference and standard books on chemistry and allied subjects, numbering about 8,000 volumes in all. The current numbers of some seventy-five periodicals are on file in the reading room. In addition the facilities of the library are supplemented by the various other libraries of the University which contain extensive collections of works in other fields of science and engineering. The reading room is open evenings. Advanced students have the privileges of the stack room.



RESEARCH LABORATORY, INORGANIC CHEMISTRY



LABORATORY OF GAS AND FUEL ANALYSIS

COURSES OF INSTRUCTION

All courses listed below are to be given in the Baker Laboratory of Chemistry. For a major in Chemistry, the following courses must be completed: (1) in Chemistry, courses 101 and 105, 205 and 206, or 210; or else 110, 115, and 203; 220 and 221, or 225; 305, 310 (first term); 405, 410 (one term); and six hours of electives; (2) in related subjects, Physics 3 and 4, German 1 or 1a unless two units have been offered for entrance; twelve additional hours to be selected from: Astronomy 180 and 181; Bacteriology 1, 43, 43a; Biochemistry 314; Biology A; Animal Biology 1; Botany 1; Geology A, 100, 311; Mathematics (the completion of courses to and including Analytic Geometry and Calculus is recommended); Physics (any course); other courses subject to approval of the Department of Chemistry.

Inorganic Chemistry

Entrance credit in chemistry does not carry with it University credit in Course 101 or 105. If a student entering the University from a preparatory school desires credit for these Courses, he must pass an examination set by the Department of Chemistry. This examination is held in Ithaca on the same day in September as the entrance examination. University credit in Courses 101 and 105 that is obtained by passing this examination does not carry with it entrance credit in Chemistry.

Examinations for those who were unavoidably absent from the final examination in Courses 101 and 105 will be held at 2 p. m. on the day before instruction begins in the fall.

*101. **General Chemistry.** Lectures. Repeated in the second term. Credit three hours.

Two sections: M W F 11; T Th S 11. *Main Lecture Room.* Professor Browne and Assistant Professor Laubengayer.

Chemistry 101 and 105 must be taken simultaneously unless permission is obtained by the student from the Dean of his college and from the Department of Chemistry to take either course alone.

*105. **General Chemistry.** Recitations and laboratory practice. Repeated in the second term. Credit three hours.

Recitations, one hour a week, to be arranged.

Laboratory sections: M F 1:40–4; T Th 1:40–4; W 1:40–4; S 8–10:30. Room 150. Professor Browne, Assistant Professor Laubengayer, and assistants.

*106. **General Chemistry.** Throughout the year. Credit three hours a term. Limited to and required of students in Engineering. Assistant Professor Laubengayer, ————, and assistants.

Lecture: *Baker* 200.

Recitations: one hour, to be arranged.

Laboratory: *Baker* 150.

*110. **Introductory Inorganic Chemistry.** Throughout the year. Credit three hours first term, two hours second term. Prerequisite, entrance credit in chemistry, or course 101. Required of candidates for the degree of Bachelor of Chemistry, and open to candidates for the degree of A.B. who intend to major in Chemistry.

Lectures: Assistant Professor Laubengayer. First term, T Th S 11; second term, T Th 11. *Baker* 107.

*115. **Introductory Inorganic Chemistry.** Recitations and laboratory practice. First term. Credit three hours. Must be taken with the first term of Chemistry 110. Assistant Professor Laubengayer and assistants.

Recitations: one hour a week, to be arranged.

Laboratory: W 1:40–4. S 8–10:30. *Baker* 50.

130. **Advanced Inorganic Chemistry.** Throughout the year. Credit three hours a term. Prerequisite or parallel courses, Chemistry 405 and 410. Assistant Professor Laubengayer. M W F 11. *Baker* 107.

Lectures. The chemical elements are discussed in the order in which they occur in the Periodic Table of Mendeléeff, with special attention to the group properties of the elements and to the relations of the groups to one another. The rare elements are treated in as great detail as are the more common elements.

135. **Advanced Inorganic Chemistry.** Either term. Credit two to six hours. Prerequisite, Chemistry 305 and 310. Professor BROWNE, Assistant Professor LAUBENGAYER, and assistants. Day and hour to be arranged. *Baker* 178 and 122.

Laboratory practice. The preparation, purification, properties, and reactions of inorganic compounds including those of the rarer elements.

Chemistry 135 is designed to accompany Chemistry 130, but either course may be taken separately.

[140. **Selected Topics in Advanced Inorganic Chemistry.** Second term. Credit two hours. Prerequisite, Chemistry 405 and 410, or special permission. Professor BROWNE. W F 9. *Baker* 107. Given in alternate years, not 1934–35.]

[150. **The Chemistry of Glass.** Second term. Credit one hour. Assistant Professor LAUBENGAYER. M 9. *Baker* 107. Open to students who have had or are taking course 405; and to others by special permission.

A discussion of the development and manufacture of glass and related ceramic ware, such as pottery and porcelain, with special emphasis on the relations between constitution and physical and chemical properties. Inspection trips to nearby ceramic plants will be arranged. Not given in 1934–35.]

195. **Research for Seniors.** Throughout the year. Credit two or more hours a term. Professor BROWNE and Assistant Professor LAUBENGAYER.

ANALYTICAL CHEMISTRY

*201. **Introductory Analytical Chemistry.** Repeated in the second term. Credit four hours. Prerequisite, Chemistry 101 and 105. Limited to students majoring in the biological sciences. Assistant Professor NICHOLS, Dr. MORSE and assistants.

Lectures: T Th 10. *Baker* 177.

Laboratory sections: W F 1:40–4; S 8–1.

A study of the fundamental principles of qualitative and quantitative analysis. Laboratory practice in gravimetric and volumetric quantitative methods.

203. **Introductory Qualitative Analysis.** Second term. Credit five hours. Prerequisite, one term of Chemistry 110 or special permission. Must be taken with the second term of Chemistry 110. Required of candidates for the degree of Bachelor of Chemistry and open to candidates for the degree of A.B. who intend to major in Chemistry. Assistant Professor NICHOLS, Mr. AVENS, and assistants.

Lecture or recitation: M 9. *Baker* 177. One other recitation, to be arranged.

Laboratory: M W F 1:40–4. *Baker* 50.

*205. **Introductory Qualitative Analysis.** First term only. Credit three hours. Prerequisite, Chemistry 101 and 105. Must be taken with Course 206. Assistant Professor NICHOLS, Mr. AVENS, and assistants. Lectures: M W 9. *Baker* 177.

Recitations: one hour a week, to be arranged.

A study of the application of the theories of general chemistry to the systematic separation and detection of the common elements and acid radicals.

*206. **Introductory Qualitative Analysis.** First term only. Credit three hours. Prerequisite, Chemistry 101 and 105. Must be taken with Course 205. Mr. AVENS and assistants.

Laboratory section: M W F 1:40–4. *Baker* 50.

Laboratory practice. A study of the properties and reactions of the common elements and acid radicals; the qualitative analysis of a number of solutions and solid compounds.

*210. **Introductory Qualitative Analysis.** Shorter course. Repeated in the second term. Credit three hours. Prerequisite, Chemistry 101 and 105. Mr. AVENS and assistants.

Lecture: T 12. *Baker* 207.
Laboratory sections: T Th 8–10:30; T Th 1:45–4. *Baker* 40.
A study of the properties and reactions of the common elements and acid radicals, and their detection in various solutions.

215. **Advanced Qualitative Analysis.** First term. Credit three hours. Prerequisite, Chemistry 220, 221, 305, and 310. Assistant Professor NICHOLS, Mr. AVENS, and assistants. Day and hour to be arranged. *Baker* 50.
Laboratory practice. Essentially a continuation of Course 206. The methods for separating and detecting a number of metals and acids not studied in Course 206, including many of the rare elements. The qualitative analysis of a number of solutions, solid mixtures, natural and commercial products will be required. For graduates and advanced undergraduates.

*220. **Introductory Quantitative Analysis.** Repeated in the second term. Credit three hours. Prerequisite, Chemistry 205 and 206. Must be taken with Course 221. Assistant Professor NICHOLS, Dr. Morse, and assistants.
Lectures: T Th 9. *Baker* 207.
Recitations: one hour a week, to be arranged.
A study of the fundamental principles of gravimetric and volumetric analysis with practice in stoichiometry.
Students in science are advised, and candidates for the degree of Bachelor of Chemistry are required, to take this course together with Course 221 instead of Course 225.

*221. **Introductory Quantitative Analysis.** Repeated in the second term. Credit three hours. Prerequisite, Chemistry 205 and 206. Must be taken with Course 220. Assistant Professor NICHOLS, Dr. MORSE and assistants.
Laboratory sections: T Th 10–12:30, Th 1:40–4; F 1:40–4, S 8–1 (first term only). *Baker* 252.
Laboratory practice in the preparation and standardization of various volumetric solutions and the analysis of a variety of substances by volumetric and gravimetric methods.
Students in science are advised, and candidates for the degree of Bachelor of Chemistry are required, to take this course together with Course 220 instead of Course 225.

*225. **Introductory Quantitative Analysis.** Shorter course. Repeated in the second term. Credit three hours. Prerequisite or parallel course, Chemistry 210. Assistant Professor NICHOLS, Dr. MORSE, and assistants.
Lecture: Th 12. *Baker* 207.
Laboratory sections: T Th 8–10:30; M W 1:40–4; T Th 1:40–4. *Baker* 252.
A study of the fundamental principles of gravimetric and volumetric analysis, and the analysis of various substances by these methods.

230. **Advanced Quantitative Analysis.** Repeated in the second term. Credit three hours Prerequisite, Chemistry 220 and 221. Assistant Professor NICHOLS, Dr. MORSE, and assistants. Recitation: one hour a week, to be arranged. Laboratory periods: first term, T Th 1:40–4; T Th 8–12:30; second term, T Th 1:40–4; T Th 8–12:30; S 8–1. *Baker* 294.
Students will be assigned to a combination of laboratory periods that will total seven and one-half hours a week.
The calibration of weights and volumetric apparatus; the analysis of ferrous and non-ferrous alloys, silicates and organic substances by various gravimetric, volumetric, and combustion methods.

235. **Advanced Quantitative Analysis.** Second term. Credit two hours. Prerequisite, first term of Chemistry 405. Assistant Professor NICHOLS. M W 12. *Baker* 207.
A discussion of selected topics in quantitative analysis and the development and present status of various analytical methods.

240. **Electrochemical Analysis.** Repeated in the second term. Credit two hours. Prerequisite, Chemistry 230 and 405. Assistant Professor NICHOLS and Dr. MORSE. Day and hour to be arranged. *Baker* 292.

Laboratory practice in the electrochemical methods for the determination of silver, lead, copper, tin, nickel, cobalt, zinc, iron, etc.; the analysis of alloys and ores.

250. **Gas and Fuel Analysis.** Second term. Credit three hours. Prerequisite, Chemistry 220 and 221. Dr. MORSE and assistants. Lectures: F 10. *Baker* 207. Laboratory sections: M W 1:40–4; T or Th 10–12:30, 1:40–4; S 8–1. *Baker* 282.

The complete analysis of coal gas, flue gas, and air, the determination of the heating power of gaseous, liquid, and solid fuels; the analysis of coal; standard methods of testing various petroleum and coal-tar products; the analysis of various substances by methods involving the use of different types of gas evolution apparatus. Problems are assigned which afford practice in the calculation and interpretation of results.

270. **Special Methods of Quantitative Analysis.** Either term. Credit two or more hours. Prerequisite, Chemistry 230 and 235. Assistant Professor NICHOLS, Dr. MORSE, and assistants. Day and hour to be arranged. *Baker* 277.

Laboratory practice in the application of special methods such as indirect analysis, conductometric and potentiometric titrations, etc., to quantitative analysis and the analysis of special materials. The study of the important methods and special forms of apparatus used in scientific gas analysis.

Within certain limits the work may be selected to suit the requirements of the individual student.

275. **Quantitative Microanalysis.** First term. Credit three or more hours. Prerequisite, Chemistry 230 and special permission. Assistant Professor NICHOLS. Day and hour to be arranged. *Baker* 282.

Laboratory practice in typical methods of both organic and inorganic quantitative microanalysis.

295. **Research for Seniors.** Throughout the year. Credit two or more hours a term. Assistant Professor NICHOLS, Dr. MORSE, and Mr. AVENS.

ORGANIC CHEMISTRY

305. **Introductory Organic Chemistry.** Throughout the year. Credit three hours a term. Prerequisite, Chemistry 210 and 225 (or 205, 206, 220, and 221). Open to those who are taking Course 220. Professor JOHNSON, Dr. TALLMAN, and Dr. CONNOR. M W F 9. *Baker* 207.

Lectures and written reviews. The more important compounds of carbon, their occurrence, methods of preparation, relations and uses; illustrated by experiments and material from the museum.

Students who have completed Chemistry 375 may register for Chemistry 305 in the second term and receive two hours credit.

310. **Introductory Organic Chemistry.** Throughout the year. Credit three hours a term. Prerequisite or parallel course, Chemistry 305. Professor JOHNSON, Dr. TALLMAN, Dr. CONNOR, and assistants. Laboratory sections, T Th 10–12:30, Th 1:40–4; F 1:40–4; S 8–1. *Baker* 250.

Laboratory practice and oral reviews. The student prepares a large number of typical compounds of carbon and familiarizes himself with their properties, reactions, and relations.

315. **Advanced Organic Chemistry.** Throughout the year. Credit two hours a term. Prerequisite, Chemistry 305 and 310. Professor JOHNSON, Dr. TALLMAN, and Dr. CONNOR. T Th 9. *Baker* 177.

Lectures. A presentation of important chapters of organic chemistry and a discussion of classical researches in this field.

Students may register for any term separately.

320. **Advanced Organic Chemistry.** Either term. Credit two to six hours a term. Prerequisite, Chemistry 305 and 310. Dr. TALLMAN, Dr. CONNOR, and assistants. Day and hour to be arranged. Conference, F 12. *Baker* 206. *Baker* 208.

Laboratory practice. An advanced course in the preparation of organic compounds. The original literature is consulted, and the student is required to repeat

LABORATORY OF ELECTRO-CHEMISTRY

some extended and important piece of work, and to compare his results with those published.

340. **Methods of Organic Analysis.** Second term. Credit four hours. Prerequisite, Chemistry 305 and 310. Dr. CONNOR and assistants. Lectures and conferences. T Th 10. *Baker* 206. Laboratory sections, T W Th 1:40–4. *Baker* 350. Laboratory work based upon Kamm: "Qualitative Organic Analysis."

With the permission of the instructor, students may register for three hours credit.

Chemistry 365. **Elementary Organic Chemistry.** Second term. Credit three hours. For students in the College of Home Economics and the Veterinary College. Prerequisite, Chemistry 101 and 105. Dr. CONNOR and assistants.

Lectures, M W 11, *Baker* 207. Laboratory M or T 1:40–4, *Baker* 250.

375. **Elementary Organic Chemistry.** First term. Lectures and laboratory, six hours credit. For students preparing for the study of medicine. Prerequisite, Chemistry 101, 105, 205, and 206 (or 210). Dr. TALLMAN, Dr. CONNOR, and assistants.

Lectures and written reviews, M W F S 9. *Baker* 207.

Laboratory sections: M W 10–12:30, or 1:40–4, *Baker* 250. Conference, M 10 or 1:40. *Baker* 207. T Th 1:40–4. *Baker* 250. Conference, T 1:40. *Baker* 207.

The student should determine the entrance requirement in Organic Chemistry for the particular medical school he wishes to enter. If more than six hours credit is required, he should register in Chemistry 305 and 310. Students may obtain 9 hours credit by taking Chemistry 305 throughout the year (6 hours) and Chemistry 310 (3 hours) during the first term.

395. **Research for Seniors.** Throughout the year. Credit two or more hours a term. Professor JOHNSON, Dr. TALLMAN, and Dr. CONNOR.

PHYSICAL CHEMISTRY

405. **Introductory Physical Chemistry.** Throughout the year. Credit three hours a term. Prerequisite, Chemistry 305 (or 375) and Physics 3 and 4. Professor BRIGGS. M W F 9. *Baker* 7.

Lectures. A systematic presentation of modern chemical theory in which special attention is paid to the following topics: Gases, liquids, and solids; the theory of solution; reaction velocity, catalysis, and chemical equilibrium; the Phase Rule; colloid chemistry; thermochemistry; and elementary electrochemistry. Problems in physical chemistry.

It is advisable, but not obligatory, that course 410 accompany this course.

410. **Introductory Physical Chemistry.** Throughout the year. Credit three hours a term. Prerequisite or parallel course, Chemistry 405. Professor BRIGGS and assistants. Laboratory sections: M T 1:40–4 or S 8–1. *Baker* 1.

Qualitative and quantitative experiments illustrating the principles of physical chemistry and including practice in performing physico-chemical measurements. An important feature of this course is the presentation of detailed reports based upon data obtained in the laboratory.

If only one term is taken, registration for the second term is advised.

415. **Advanced Physical Chemistry.** Throughout the year. Credit two hours a term. Prerequisite, Chemistry 405. Professor BANCROFT. T Th 11. *Baker* 7.

An exposition of the law of mass action in its application to chemical equilibrium and reaction velocities.

420. **Special Topics in Physical Chemistry.** First term. Credit three hours. Prerequisite, Chemistry 405 and at least one term of 410. Required of candidates for the degree of Bachelor of Chemistry. Professor BRIGGS and assistants. Lectures: M W 12. *Baker* 7. Laboratory: T W Th or F 1:40–4. *Baker* 1-A.

This course is a continuation of courses 405 and 410, and includes such topics as thermodynamics and the Phase Rule, electrochemistry, and photochemistry.

430. **Applied Colloid Chemistry.** Throughout the year. Credit two hours a term. Open to candidates for the degree of Bachelor of Chemistry if they have completed Chemistry 405, to others only by special permission. Professor BANCROFT. T Th 10. *Baker* 7.

Lectures. The theory of colloid chemistry and its application in the arts.

450. **Applied Electrochemistry.** Throughout the year. Credit two hours a term. Prerequisite, Chemistry 405. Professor BRIGGS. M W 12. *Baker* 7.

Lectures. The theory of electrolysis and electromotive force; electrolytic extraction and refining of metals; electrolytic manufacture of organic and inorganic compounds; theory and practice of storage cells; preparation of compounds in the electric furnace. Problems in electrochemistry.

455. **Applied Electrochemistry.** Throughout the year. Credit two hours a term. Prerequisite or parallel course, Chemistry 450. Professor BRIGGS and assistant. Day and hour to be arranged. *Baker* 1–A.

Laboratory practice. Qualitative and quantitative study of electrolysis; determination of electrical conductivity; potentiometric measurements; hydrogen ion concentration; determination of current and energy efficiencies in electrolytic and electrothermal work; electrolytic preparation of organic and inorganic compounds; tests of storage cells; preparation of compounds in the electric furnace; measurement of furnace temperatures.

[460. **Theoretical Electrochemistry.** Throughout the year. Credit two hours a term. Prerequisite, Chemistry 405. Professor BANCROFT. T Th 11. *Baker* 7. Given in alternate years, not in 1934–35.]

465. **Advanced Physical Chemistry.** Either term. Credit variable, but not to exceed six hours a term. Prerequisite, determined in each case by the Professor in charge. Professors BANCROFT and BRIGGS and assistants. Hour and work to be arranged. *Baker* 94.

Laboratory practice. Students may elect in mass law, reaction velocity, or efficiency measurements with special reference to course 415; in photo-chemistry, photography, or colloid chemistry with special reference to course 430; in conductivity, or electrometric determinations with special reference to course 460; in electrolytic, or electric furnace products with special reference to course 450, in the application of physical chemical methods to organic chemistry.

495. **Research for Seniors.** Throughout the year. Professors BANCROFT and BRIGGS. Credit two or more hours a term.

OPTICAL CHEMISTRY

505. **Introductory Chemical Spectroscopy.** Repeated in the second term. Credit three hours. Prerequisite, Chemistry 210 and 225 (or 205, 206, 220, and 221). Open to those who have completed or are taking Physics 31 and 32, or by special permission. Professor PAPISH and assistant.

Lectures and written reviews. T Th 9. *Baker* 377.

Laboratory sections: M T W Th F 1:40–4. *Baker* 396.

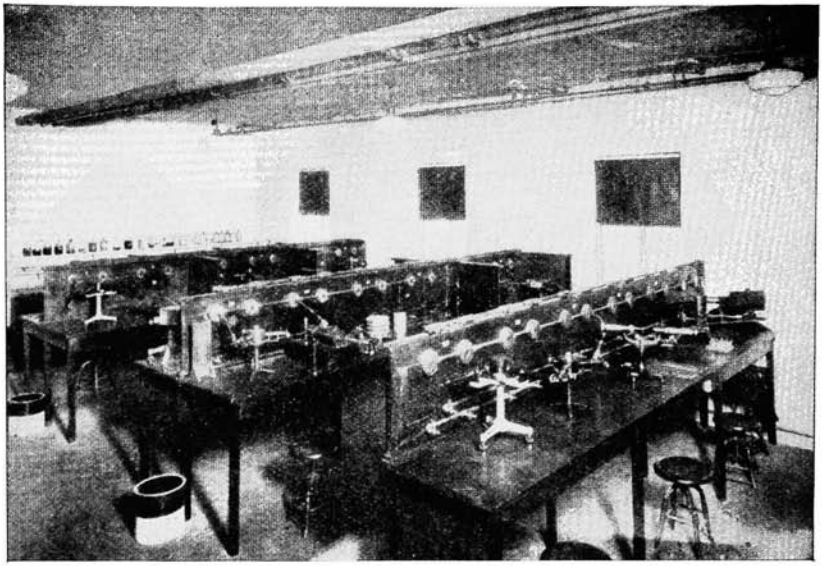
The construction and the use in chemical analysis of the spectroscope, polariscope, refractometer, colorimeter, and nephelometer. The laboratory instruction is devoted to the training of the student in the use of these instruments in the solving of chemical problems.

Graduate students are advised to take this course the second term.

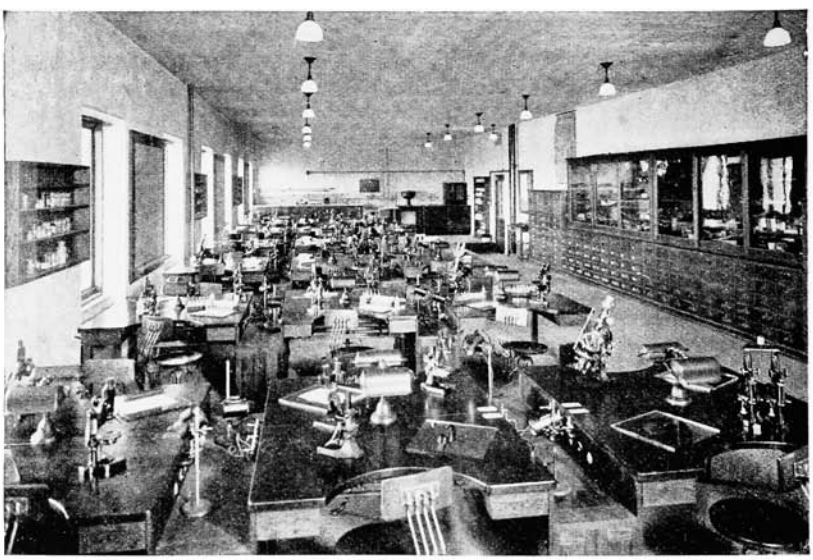
510. **Advanced Chemical Spectroscopy.** Either term. Credit two or more hours. Prerequisite, Chemistry 505. Professor PAPISH and assistant. Day and hour to be arranged. *Baker* 396.

Laboratory practice. The study of arc, spark, and absorption spectra and the application of spectroscopic methods to the identification of dyestuffs. Practice in one or more of the subjects mentioned may be selected by the student.

520. **Spectrographic Methods.** Either term. Credit one or more hours. Prerequisite, Chemistry 505. Professor PAPISH. Laboratory hours to be arranged. *Baker* 396. Conference, hour to be arranged.



LABORATORY OF INTRODUCTORY CHEMICAL SPECTROSCOPY



LABORATORY OF INTRODUCTORY CHEMICAL MICROSCOPY

Laboratory practice. The application of photographic methods to arc, spark, and absorption spectroscopy. Practice is also given in the application of ultraviolet spectroscopy in chemical analysis.

530. **Introductory Chemical Microscopy.** Repeated in the second term. Credit three hours. Prerequisite, Chemistry 210 and 225 (or 205, 206, 220, and 221) and Physics 21 and 22, or special permission. Professors CHAMOT and MASON, and assistants.

Lecture: M 10. *Baker* 377.

Laboratory sections: M T 1:40–4; T Th 9–11:30; Th F 1:40–4 (second term only). *Baker* 478.

Lectures and laboratory practice. The use of the microscope and its accessories; microscopic methods as applied to chemical and other scientific investigations; micrometry; the examination of crystalline compounds and industrial materials; recognition of textile and paper fibers, etc. The application of microscopic methods to quantitative analysis.

Graduate students are advised to take this course the first term.

535. **Microscopic Qualitative Analysis (Inorganic).** Either term. Credit two or more hours. Prerequisite, Chemistry 530. Professors CHAMOT and MASON, and assistants. Laboratory periods, to be arranged. *Baker* 378.

Laboratory practice in the examination and analysis of inorganic substances containing the more common elements with special reference to rapid qualitative methods and to the analysis of minute amounts of material.

540. **Microscopical Methods in Organic Chemistry.** Either term. Credit two or more hours. Prerequisite, Chemistry 530, and special permission. Professors CHAMOT and MASON, and assistants. Day and hour to be arranged. *Baker* 378.

Laboratory practice. General manipulative methods applicable to small amounts of material, crystallization procedures, determination of melting points and molecular weights; chemical tests and reactions for elements, radicals, and various types of organic compounds. Preparation of simple derivatives.

This course may be extended to cover the analytical reactions of the vegetable alkaloids, "strong drugs," or other special groups of organic substances.

545. **Metallography.** First term. Credit two hours. Prerequisite, Chemistry 530, or special permission. Professor MASON and assistants. Th F 1:40–4. *Baker* 384.

Laboratory practice, conferences and reports. An introduction to the principles and methods involved in the study of the structure of metals. The relation of microscopical appearances to thermal history and mechanical properties. Preparation of specimens for macroscopic and microscopic study. Metallographic microscopes and their use.

This course is planned approximately to parallel the lectures in the first term of course 705.

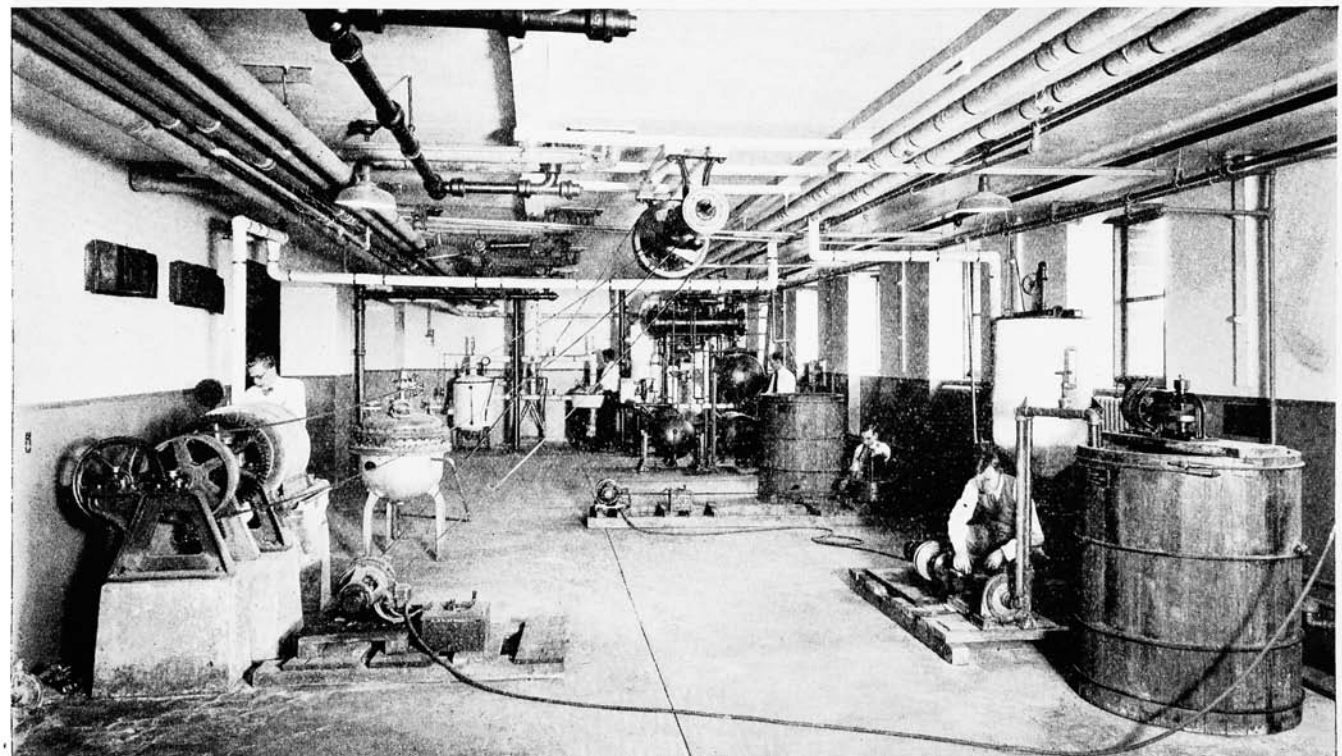
[560. **Advanced Chemical Microscopy.** Second term. Credit two hours. Hours to be arranged. Professor MASON.

Conferences and demonstrations. Theory and applications of instruments-accessories and methods used in critical microscopy, ultramicroscopy, photomicrography, and other special fields. Typical applications of microscopic methods in research and industry. Not given in 1934–35.]

565. **Special Methods in Chemical Microscopy.** Either term. Credit one or more hours. Prerequisite, special permission. Professors CHAMOT and Mason. Day and hour to be arranged. *Baker* 378 and 382.

Laboratory practice may be elected in various fields such as photomicrography, ultramicroscopy, crystal studies, micro-manipulations, quantitative determinations, and the microscopy of industrial materials, textiles, papers, and foods.

595. **Research for Seniors.** Throughout the year. Credit two or more hours a term. Professors CHAMOT, PAPISH, and MASON.



LABORATORY OF INDUSTRIAL PROCESSES

Sanitary Chemistry

The courses in Sanitary Chemistry, which are under the direction of Professor Chamot, *will not be offered in 1934–35.*

[615. **Introductory Sanitary Chemistry (Water).** Second term. Credit two hours. Prerequisite, Chemistry 305 (or 210, 225, and 375). T Th 11. *Baker* 377.

Lectures. Pollution of water; physical, chemical, bacteriological, and microscopical examination of water for household and municipal purposes; introduction to the methods of water purification, and water softening, and their control. Interpretation of analytical results and the preparation of sanitary surveys. Not given in 1934–35.]

It is advisable, but not obligatory, that Course 620 accompany this course.

[620. **Introductory Sanitary Chemistry (Water).** Second term. Credit two hours. Prerequisite or parallel course, Chemistry 615. Laboratory sections at hours to be arranged. *Baker* 352.

Laboratory practice. Laboratory exercises designed to illustrate the material presented in Course 615. Not given in 1934–35.]

[630. **Advanced Sanitary Chemistry (Water).** First term. Credit two hours. Prerequisite, Chemistry 615.

Laboratory practice to accompany this course may be elected under Course 635. Not given in 1934–35.]

[635. **Advanced Sanitary Chemistry.** Either term. Credit two or more hours. Prerequisite, to be determined in each case by the instructor in charge. *Baker* 352, 356, 358.

Laboratory practice.

Students who have had adequate preparation may elect work in any branch of sanitary chemistry. Among others, work along the following lines may be taken:

The bacteriology of water.

Continuation of work offered in courses 610 or 620.

The control of water purification.

Water softening.

The work in many cases may be arranged to meet the need of the individual student. Not given in 1934–35.]

[695. **Research for Seniors.** Throughout the year. Credit two or more hours a term. Professor Chamot. Not given in 1934–35.]

Industrial Chemistry

705. **Industrial Chemistry.** Throughout the year. Credit three hours a term. Prerequisite, Chemistry 405. Professor Rhodes. W M F 10. *Baker* 177.

Lectures. A discussion of various typical processes of chemical manufacturing from the standpoint of: (a) available materials, their properties and limitations; (b) standard forms of apparatus used in chemical manufacturing; (c) properties and specifications of commercial chemicals; (d) computation of costs and profits in chemical manufacturing.

By special permission, candidates for the degree of Bachelor of Chemistry may be permitted to register for the second term of Course 705 in their junior year and to postpone a part of their elective hours until the senior year.

710. **Chemical Engineering.** Second term. Credit four hours. Prerequisite, Chemistry 405. Professor Rhodes, Mr. ————, and assistants. Laboratory period, day and hour to be arranged. *Baker* B-78. Conference period, Th 11. *Baker* 207.

The study in the laboratory, on a semi-plant scale, of the unit processes of chemical engineering, such as agitation, and mixing, filtration, fractional distillation, evaporation, drying, absorption of gases, and heat transfer.

715. **Selected Topics in Chemical Engineering.** Second term. Credit three hours. Prerequisite or parallel course, Chemistry 705. Professor Rhodes. M W F 11. *Baker* 177.

Lectures. A discussion of special topics in industrial chemistry.

725. **The Chemistry of Fuels.** First term. Credit three hours. Prerequisite or parallel course, Chemistry 705. Professor RHODES. M W F 11. *Baker* 177.

Lectures. The chemistry of coal, coke, petroleum tars, and the fuel gases. Particular stress is laid upon the theoretical chemistry involved in the carbonization of coal, the gasification of coal, and the distillation and refining of petroleum and tar.

730. **Chemical Plant Design.** Throughout the year. Credit three hours a term. Prerequisite, Chemistry 705. Professor RHODES. Day and hour to be arranged.

Conferences and calculation periods. Practice in the calculation and design of chemical plant equipment.

795. **Research for Seniors.** Throughout the year. Credit two or more hours a term. Professor RHODES and Mr. ————.

AGRICULTURAL CHEMISTRY

Students will not be allowed to register in courses in Agricultural Chemistry until after they have taken and passed Chemistry 101 and 105 or their equivalent.

805. **Introductory Agricultural Chemistry (Fertilizers, Insecticides, Soils).** First term. Credit two hours. Prerequisite, Chemistry 305 (or 375). Professor CAVANAUGH. T Th 11. *Baker* 302.

Lectures. The relation of chemistry to agriculture; an introduction to the study of plant growth, the composition and chemical properties of soils, fertilizers, amendments, insecticides, and fungicides.

810. **Introductory Agricultural Chemistry.** First term. Credit three hours. Prerequisite, Chemistry 205 and 220 (or 210 and 225). Professor CAVANAUGH and assistant. *Baker* 350.

Laboratory practice: day and hour to be arranged. Recitation: day and hour to be arranged. Practice in the methods used by the chemist in the control laboratories of the factory, of the Government, and of the Experiment Stations, where fertilizers, insecticides, fungicides, and soils are examined.

815. **Introductory Agricultural Chemistry (Foods and Feeds).** Second term. Credit two hours. Prerequisite, Chemistry 305 (or 375). Professor CAVANAUGH. T Th 11. *Baker* 302.

Lectures. Discussion of the sources, chemical composition, and properties of the principal foods and feeds such as cereals, fruits, animal products, and dairy products. Relation of methods of preservation and manufacture to the nutritive value of foods.

820. **Introductory Agricultural Chemistry.** Second term. Credit three hours. Prerequisite, Chemistry 205 and 220 (or 210 and 225). Professor CAVANAUGH and assistant. *Baker* 350.

Laboratory practice: day and hour to be arranged. Recitation: day and hour to be arranged. The methods of the Association of Official Agricultural Chemists are used in the examination and analysis of foods and feeding stuffs, such as milk and milk products, cereal products, canned vegetables, etc.

*825. **Elementary Agricultural Chemistry.** Second term. Credit three hours. Prerequisite, Chemistry 101. Professor CAVANAUGH. M W F 12. *Baker* 377. Candidates for the degree of Bachelor of Chemistry may not receive credit for this course toward the degree.

Lectures. The relation of chemistry to agriculture, and an introduction to the study of the composition and chemical properties of plants, fertilizers, feed stuffs, insecticides, and fungicides.

*830. **Elementary Chemistry of Food Products.** Second term. Credit two hours. Prerequisite, Chemistry 101. Professor CAVANAUGH. W F 10. *Baker* 377. Candidates for the degree of Bachelor of Chemistry may not receive credit for this course toward the degree.

Lectures. The chemical composition, physical and physiological properties, sources, and methods of manufacture of the principal food products.

835. **Advanced Agricultural Chemistry (Fertilizers, Insecticides, Soils).** Either term. Credit two or more hours. Prerequisite, Chemistry 810. Professor CAVANAUGH and assistant. Day and hour to be arranged. *Baker* 350.

Laboratory practice. Advanced work in the chemistry of soils, fertilizers, plant composition, insecticides, or fungicides. Special topics may be selected.

840. **Advanced Agricultural Chemistry (Foods and Feeds).** Second term. Credit two or more hours. Prerequisite, Chemistry 820. Professor CAVANAUGH. Day and hour to be arranged. *Baker* 350.

Laboratory practice. Special topics in the chemistry of foods and food preparations.

895. **Research for Seniors.** Throughout the year. Credit two or more hours a term. Professor CAVANAUGH.

SPECIAL TOPICS

910. **Special Topics in Chemistry.** Second term. Credit one hour. Required of candidates for the degree of Bachelor of Chemistry. T 11. *Baker* 207.

The use of chemical literature; methods of research; administration of chemical laboratories; patent law; and other special topics.

1000. **Non-Resident Lectures on the George Fisher Baker Foundation.** Credit two hours. T Th 12. *Baker* 177. Open to seniors in the course in Chemistry, and to juniors on special permission.

First term: Professor J. R. KATZ, University of Amsterdam, Holland. Topic of lectures: The Study of Substances of High Molecular Weight by means of X-rays.

Second term: Professor FARRINGTON DANIELS, University of Wisconsin. Topic of lectures: Chemical Kinetics. Gas reactions; reactions in solution; chain reactions; mathematical considerations; applications to photochemistry; applications of quantum theory.

CORNELL UNIVERSITY OFFICIAL PUBLICATION

Entered as second-class matter, December 14, 1916, at the post office at Ithaca New York, under the Act of August 24, 1912.

Published at Ithaca, New York, monthly, September to November, and semi-monthly, December to August.

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