

CORNELL UNIVERSITY OFFICIAL PUBLICATION

Volume XVII

Number II

The College of Arts and Sciences
Announcement of the
Department of Chemistry
1926-27

Ithaca, New York
Published by the University
May 1, 1926

DEPARTMENT OF CHEMISTRY: LECTURE SCHEDULE
FIRST TERM

<i>Hour</i>	MON.	TUE.	WED.	THUR.	FRI.	SAT.	<i>Hour</i>
8	775	505	775	505			8
9	205 245 305 405	220 315 630	205 305 405	220 315 630	305 405 525		9
10	705	430	705	430	705		10
11	101 ¹ 130 250 725	101 ² 415 460 605 805	101 ¹ 130 250 725	101 ² 415 460 605 805	101 ¹ 130 325 725	101 ²	11
12	255 375 450 530	210 535	255 375 450	225 520	375	375	12

SECOND TERM

<i>Hour</i>	MON.	TUE.	WED.	THUR.	FRI.	SAT.	<i>Hour</i>
8	775	505	775	505			8
9	205 305 405	140 220 315 640	205 305 405 542	140 220 315 640	305 405 542		9
10	530 705	430 776	705 880	430 776	705 880		10
11	101 ¹ 130 250 715	101 ² 415 460 615 815	101 ¹ 130 250 715	102 ² 415 460 615 815	101 ¹ 130 335 715	101 ²	11
12	235 450 875	210 550	235 450 875	225 520	875		12

DEPARTMENT OF CHEMISTRY

STAFF OF INSTRUCTION

LOUIS MUNROE DENNIS, D.Sc., Professor of Inorganic Chemistry.
WILLIAM RIDGLEY ORNDORFF, Ph.D., Professor of Organic Chemistry.
WILDER DWIGHT BANCROFT, Ph.D., D.Sc., Professor of Physical Chemistry.
GEORGE WALTER CAVANAUGH, B.S., Professor of Agricultural Chemistry.
EMILE MONNIN CHAMOT, Ph.D., Professor of Chemical Microscopy and Sanitary Chemistry.
ARTHUR WESLEY BROWNE, Ph.D., Professor of Inorganic Chemistry.
FRED HOFFMAN RHODES, Ph.D., Professor of Industrial Chemistry.
THOMAS ROLAND BRIGGS, Ph.D., Professor of Physical Chemistry.
MELVIN L. NICHOLS, Ph.D., Assistant Professor of Analytical Chemistry.
JACOB PAPISH, Ph.D., Assistant Professor of Chemical Spectroscopy.
ASA EMANUEL MCKINNEY, Ph.D., Assistant Professor of Inorganic Chemistry.
FREDERICK RAYMOND GEORGIA, Ph.D., Instructor in Sanitary Chemistry.
CLYDE WALTER MASON, Ph.D., Instructor in Chemical Microscopy.
EDGAR BLAUVELT JOHNSON, Ph.D., Instructor in Industrial Chemistry.
CHARLES WALTER MORSE, B.Chem., Instructor in Analytical Chemistry.
ROBERT BRAINARD COREY, Ph.D., Instructor in Analytical Chemistry.
JACK MISCALL, M.S., Instructor in Agricultural Chemistry.
CARL WILLIAM TUCKER, M.S., Instructor in Analytical Chemistry.
IRVING TRACY BEACH, B.Chem., Instructor in Organic Chemistry.

ASSISTANTS IN CHEMISTRY

FRANK OSCAR AGEL.	JOHN CALVIN KELLER, B.S.
NICHOLAS BACON, B.Chem.	THEODORE GLADDEN KENNARD, B.A.
GEORGE MONROE BATEMAN, B.S.	LAWRENCE GANE KNOWLTON, A.B.
IRVING TRACY BEACH, B.Chem.	WALTER BRAMBLE KUNZ, B.A., M.A.
GILBERT RICHARD BEEBE, B.Chem.	WAYNE EDWARD KUHN, B.A.
ARTHUR EDSON BIRCH, B.S.	LOUIS LEONARD LARSON, B.S.
LEON EVANS BOWE, A.B.	ALBERT WASHINGTON LAUBENGAYER, B.Chem.
SEYMOUR WILSON BRAINARD, B.S.	HAROLD ADLARD LOVENBURG, B.Chem.
MILTON LESTER BYRON, B.Chem.	MAURICE JACKSON MURRAY, A.B.
PETER PANAGIOTES CARODEMOS, B.S.	WINTON IRVING PATNODE.
EDWIN SMITH DAY, A.B.	FELIX EDWARD REIFSCHNEIDER, B.Chem.
RAYMOND HERBERT FLECKENSTEIN, B.Chem.	HARRIS WHITE ROGERS, B.S., M.S.
CHARLES REDMAN FORDYCE, A.B., M.A.	CHARLES BLACKMER RUTENBER, B.Chem.
JAMES WILLIAM FRAZE, A.B., M.A.	CHARLES HAMILTON SAYLOR, B.Chem.
HAROLD ELLSWORTH GOLDSMITH, B.Chem.	CARLISLE SCHADE, B.Chem.
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DONALD AUBREY HOLT, B.Chem.	JOHN VERTREES STARR, A.B.
HARRY JAMES HOSKING, B.S.	CARL WILLIAM TUCKER, B.S., M.S.
ROBERT CHARLES HOUCK, B.Chem.	WESLEY GABRIEL VANNOY, B.S., M.S.
HENRY PIERCE HOUSE, A.B., M.A.	ROMULUS SEITZ VON HAZMBURG, B.Chem.
EDWARD WESLEY HUGHES, B.Chem.	CHARLES OLIVER WILLITS, B.S.
HOWARD LOUIS HUNTER, B.Chem.	
ERNEST JACOB JOSS, A.B., M.A.	

FELLOWS AND SCHOLARS IN CHEMISTRY

1925-26

The Sage Fellowship: LUDWIG FREDERICK AUDRIETH, B.S.
 The Grasselli Fellowship: HAROLD TALBOT LACEY, B.Chem.
 The Du Pont Fellowship: CHRISTOPHER JOHN WELZ, M.S.
 Graduate Scholarship: KATHARINA MARJORIE TRESSLER, A.B.
 The Grasselli Undergraduate Scholarship: ROBERT MAX HERBST.

COLLEGE OF ARTS AND SCIENCES

THE COURSE IN CHEMISTRY

The College of Arts and Sciences offers a four-year course leading to the degree of Bachelor of Chemistry. This course is designed primarily to prepare the student for the profession of chemistry, either in the field of teaching or in the chemical industries. It includes adequate instruction in allied subjects, such as Mathematics, Physics, and Engineering, that are usually comprised in courses elsewhere designated "Chemical Engineering." It moreover includes extended instruction not only in the fundamental divisions of chemical science, but also in numerous special branches designed to acquaint the student with the best modern methods of attacking the many varied problems that may arise in the future practice of his profession.

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

THE DEGREE OF BACHELOR OF CHEMISTRY

The degree of Bachelor of Chemistry will be awarded to those who have satisfactorily completed the following curriculum and the requirements prescribed by the University in Hygiene and Preventive Medicine and in Military Drill or in Physical Training.

Students who do not present, on entrance, at least two units of French and two units of German, will be required to make up the shortage before the beginning of the junior year. This may not be done, except with special permission of the Department, by taking University courses in French or German during the academic year.

THE CURRICULUM

FIRST YEAR

Course		First Term	Second Term
Introductory Inorganic Chemistry	Chemistry 101	3	—
Inorganic Chemistry Laboratory	Chemistry 105	3	—
Introductory Qualitative Analysis	Chemistry 205	—	3
Qualitative Analysis Laboratory	Chemistry 206	—	3
Analytic Geometry and Calculus	Mathematics 5a, 7	5	5
Introductory Experimental Physics	Physics 5	—	5
Drawing	Engineering 125	3	—
English	English 1	3	3

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	—
Introductory Chemical Spectroscopy.....	Chemistry 505	—	3
Gas and Fuel Analysis.....	Chemistry 250	4 or 0	0 or 4
Elementary Mineralogy.....	Geology 311	0 or 3	3 or 0
Heat and Light.....	Physics 31	2	—
Magnetism and Electricity.....	Physics 32	—	2
Physical Experiments.....	Physics 14	—	2

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 Microscopy.....	Chemistry 530	3	—
Quantitative Analysis, Lectures.....	Chemistry 235	—	2
Advanced Quantitative Analysis.....	Chemistry 230	—	4
Physical Experiments.....	Physics 14	2	—
Elective.....	(at least)	4	4

FOURTH YEAR

Introductory Industrial Chemistry.....	Chemistry 705	3	3
Seminary.....	Chemistry 905	—	1
Research for Seniors.....	Chemistry	4	4
Mechanical Laboratory.....	Engineering 367	—	4
Electrical Engineering.....	Engineering 417	4	—
Elective.....	(at least)	6	6

Candidates for the degree of Bachelor of Chemistry are required to take at least eight hours in research during the senior year in a division of the Department to be selected by the student. These divisions are: Inorganic Chemistry (Course 195); Analytical Chemistry (Course 295); Organic Chemistry (Course 395); Physical Chemistry (Course 495); Optical Chemistry (Course 595); Sanitary Chemistry (Course 695); Industrial Chemistry (Course 795); Agricultural Chemistry (Course 895).

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

Students in the Course in Chemistry may register for 20 hours a term. To register for more than 20 hours, the student must first secure the consent of the Department.

THE HONOR CODE IN EXAMINATIONS

Under a constitution proposed and adopted by the students, and approved by the University Faculty on March 9, 1921, all students of Cornell University are put upon their honor with respect to their conduct in examinations and in other tests of work by which they are earning academic credit. The students have made themselves responsible for maintaining the code. For the trial of charges of breach of honor they elect committees of their own—a central committee

for the University, and a committee in each of the colleges. Every student is expected to do his share in upholding the code, not only by honorable conduct on his own part, but also by refusal to conceal or condone fraud on another's part. A fraud observed in any college should be reported to a member of the student honor Committee of that college.

COURSES OF INSTRUCTION

All courses listed below are to be given in the Baker Laboratory of Chemistry.

Those courses which are marked with the asterisk () may not be counted for upper-class group by candidates for the degree of Bachelor of Arts.*

INORGANIC CHEMISTRY

***101. Introductory Inorganic Chemistry.** Repeated in the second term. Credit three hours. Professor BROWNE and Assistant Professor MCKINNEY. Lectures: M W F, 11, T Th S, 11. Baker, Main Lecture Room.

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 in these courses he must pass an examination set by the Department of Chemistry. This examination is held in New York City and 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 course 101 will be held at 2 p. m. on the day before instruction begins in the fall.

***105. Introductory Inorganic 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 2-4:30; T Th 2-4:30; W 2-4:30, S 8-10:30. Room

150. Professor BROWNE, Assistant Professor MCKINNEY, and assistants.

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

130. Advanced Inorganic Chemistry. Throughout the year. Credit three hours a term. Prerequisite or parallel courses, Chemistry 405 and 410. Professor DENNIS. 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 and the rare earths are treated in as great detail as are the more common elements.

135. Advanced Inorganic Chemistry. Either term. Credit one to six hours. Prerequisite, Chemistry 305 and 310. Professors DENNIS and BROWNE 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, or parallel courses, Chemistry 405 and 410. Professor BROWNE. Not given in 1926-27.]

195. Research for Seniors. Throughout the year. Professors DENNIS and BROWNE and Assistant Professor MCKINNEY. See page 5.

ANALYTICAL CHEMISTRY

205. Introductory Qualitative Analysis. Repeated in the second term. Credit three hours. Prerequisite, Chemistry 101 and 105. Must be taken with Course

206. Assistant Professor NICHOLS, Dr. COREY, and assistants.

Lectures: Assistant Professor NICHOLS, M W F 9. *Baker 107.*

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.

Students in science are advised, and candidates for the degree of Bachelor of Chemistry are required, to take this course together with Course 206 instead of Course 210.

206. Introductory Qualitative Analysis. Repeated in the second term. Credit three hours. Prerequisite, Chemistry 101 and 105. Must be taken with Course 205. Assistant Professor NICHOLS, Dr. COREY, and assistants.

Laboratory section: M W F 2-4:30. *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.

Students in science are advised, and candidates for the degree of Bachelor of Chemistry are required, to take this course together with Course 205 instead of Course 210.

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

Lectures: Dr. COREY. T 12. *Baker 207.*

Laboratory sections: T Th 8-10:30; T Th 2-4:30. *Baker 50.*

The properties and reactions of the common elements and acids; their detection in various liquid and solid mixtures.

215. Advanced Qualitative Analysis. Second term. Credit one, two, or three hours. Prerequisite, Chemistry 220, 221, 305, and 310. Assistant Professor NICHOLS, Dr. COREY, 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, Mr. TUCKER, and assistants.

Lectures: Assistant Professor NICHOLS. 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, Mr. TUCKER, and assistants.

Laboratory Sections: First term, M T W 2-4:30; T Th 10-12:30, S 8-1; second term, W Th F 2-4:30; T Th 10-12:30, S 8-1. *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. Mr. TUCKER and assistants.

Lecture: Mr. TUCKER. Th 12. *Baker 207.*

Laboratory sections: T Th 8-10:30; T Th 9-11:30; M W 2-4:30; T Th 2-4:30. *Baker 252.*

A study of the fundamental principles of quantitative and volumetric analysis.

230. Advanced Quantitative Analysis. Repeated in the second term. Credit four hours. Prerequisite, Chemistry 220 and 221. Assistant Professor NICHOLS, Mr. TUCKER, and assistants.

Recitation: one hour a week, to be arranged.

Laboratory periods: first term, M T W 2-4:30; T Th 9-1, S 8-1; second term, M T W Th F 2-4:30, T Th S 8-1. *Baker 277 and 294.* Students will be assigned to a combination of laboratory periods that will total seven and one-half hours a week.

Gravimetric, volumetric, and electrolytic methods of analysis, and methods of combustion analysis; the calibration of weights and volumetric apparatus; analysis of iron and steel, alloys, silicates, etc.

235. Advanced Quantitative Analysis. Second term. Credit two hours. Prerequisite, first term of Chemistry 405. Assistant Professor NICHOLS. M W 12. *Baker 207.*

Lectures: Selected topics in advanced quantitative analysis, stoichiometry.

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

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

245. Assaying. First term. Credit two hours. Prerequisite, Chemistry 225 (or 220 and 221), and, if possible, a course in mineralogy. Mr. TUCKER and assistant.

Lecture: Mr. TUCKER. M 9. *Baker 202.*

Laboratory sections: M 2-4:30; W 2-4:30. *Baker B-91 and B-96.*

Lectures on the theory and practice of scorification and crucible assay, and on the metallurgy of copper, lead, zinc, silver, and gold; laboratory practice in the assay of zinc, lead, copper, gold and silver ores, mattes, and bullion. Designed for students in Chemistry and Geology, and as an elective in Mechanical and Civil Engineering.

250. Gas and Fuel Analysis. Repeated in the second term. Credit four hours. Prerequisite, Physics 5. Open to those who have completed or are taking Chemistry 220 and 221. Mr. MORSE and assistants.

Lectures: Mr. MORSE. M W 11. *Baker 207.*

Laboratory sections: M T 2-4:30; W Th 2-4:30; T Th 10-12:30; 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.

255. Advanced Gas Analysis. First term. Credit two hours. Prerequisite, Chemistry 250. Assistant Professor NICHOLS. M W 12. *Baker 207.*

Lectures. A presentation of important methods and a discussion of special forms of apparatus used in scientific gas analysis.

260. Advanced Gas Analysis. Either term. Credit two hours. Prerequisite, Chemistry 250. Assistant Professor NICHOLS, Mr. MORSE, and assistants. Day and hour to be arranged. *Baker 282.*

Laboratory practice. The use of special forms of apparatus; practice in the design and construction of apparatus for scientific investigation in this field. Course 260 is designed to accompany Course 255, but either course may be taken separately.

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

Laboratory practice in the application of special methods such as indirect analysis, conductivity, electrometric, titrations, etc. to quantitative analysis, and the analysis of special steels, ores, slags, alloys, etc.

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

295. **Research for Seniors.** Throughout the year. Assistant Professor NICHOLS and Dr. COREY. See page 5.

ORGANIC CHEMISTRY

305. **Introductory Organic Chemistry.** Throughout the year. Credit three hours a term. Prerequisite, Chemistry 210 and 225 (205, 206, 220 and 221). Open to those who are taking Course 220. Professor ORNDORFF and Mr. BEACH. M W 9, *Baker* 207; F 9, *Baker, Main Lecture Room.*

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.

310. **Introductory Organic Chemistry.** Throughout the year. Credit three hours a term. Prerequisite or parallel course, Chemistry 305. Professor ORNDORFF, Mr. BEACH, and assistants. Laboratory sections: M 2-4:30, T 10-12:30, 2-4:30; F 2-4:30, 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. The detection of inorganic elements in organic compounds and the recognition of various groups of radicals, with the identification of unknown compounds, is included in the laboratory work.

315. **Advanced Organic Chemistry.** Throughout the year. Credit two hours a term. Prerequisite, Chemistry 305 and 310. Professor ORNDORFF and Mr. BEACH. T Th 9. *Baker* 206.

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

320. **Advanced Organic Chemistry.** Either term. Credit two to six hours a term. Prerequisite or parallel course, Chemistry 315. Professor ORNDORFF, Mr. BEACH and assistants. Day and hour to be arranged. *Baker* 208.

Laboratory practice. An advanced course in the preparation of organic compounds. The original literature is consulted, and before taking up original work in this field, the student is required to repeat some extended and important piece of work, and to compare his results with those published.

325. **The Coal Tar Dyestuffs.** First term. Credit one hour. Prerequisite or parallel course, Chemistry 315. Professor ORNDORFF. F 11. *Baker* 206.

Discussion of methods of manufacture of intermediates and dyestuffs and of their properties, constitution, and relationships. The treatment is scientific rather than technical.

330. **The Coal Tar Dyestuffs.** Either term. Credit two to four hours a term. Prerequisite or parallel course, Chemistry 325. Professor ORNDORFF and Mr. BEACH. Day and hour to be arranged. *Baker* 208.

Laboratory practice. Preparation of various intermediate products used in the manufacture of dyes, and of representatives of the different groups of dyestuffs.

[335. **Stereochemistry.** Second term. Credit one hour. Prerequisite, Chemistry 305. Professor ORNDORFF. F 11. *Baker* 206.

Lectures. The stereochemistry of the compounds of carbon and nitrogen. The necessity of considering the space relations of the atoms in certain classes of isomers is shown and the close agreement of facts and theory is brought out. Not given in 1926-27.]

340. **Methods of Organic Analysis.** Either term. Credit two to six hours a term. Prerequisite, Chemistry 305 and 310. Professor ORNDORFF and Mr. BEACH. Day and hour to be arranged. *Baker* 208.

Laboratory practice in the qualitative and quantitative analysis of commercial organic products such as alcohols, ethers, organic acids, glycerin, formalin, acetates, coal tar distillates, petroleum products, soaps, acetanilide, etc.

375. **Elementary Organic Chemistry.** First term. Lectures and written reviews only, four hours credit; with laboratory, five to six hours credit. Students who are preparing for the study of medicine must take the entire six hours.

Prerequisite, Chemistry 210 and 225 (205, 206, 220 and 221). Open to those who are taking course 220. Mr. BEACH and assistants.

Lectures and written reviews, Mr. BEACH. M W F S 12. *Baker, Main Lecture Room.*

Laboratory section and oral reviews, M W 2-4:30. *Baker 250.*

395. Research for Seniors. Throughout the year. Professor ORNDORFF. See page 5.

PHYSICAL CHEMISTRY

405. **Introductory Physical Chemistry.** Throughout the year. Credit three hours a term. Prerequisite, Chemistry 305 (or 375) and Physics 5 and 31. 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 2-4:30; S 8-1. *Baker 1.*

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

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.

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.*

Lectures. The historical development of the subject with special reference to the theory of the voltaic cell. For advanced students in Chemistry or Physics. Not given in 1926-27.]

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. See page 5.

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. Assistant Professor PAPISH and assistants.

Lectures and written reviews. Assistant Professor PAPISH. T Th 8. *Baker 377.*

Laboratory sections: M W F 2-4:30. *Baker 392 and 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.

510. **Advanced Chemical Spectroscopy.** Either term. Credit two or more hours. Prerequisite, Chemistry 505. Assistant Professor PAPISH and assistants. 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. Assistant Professor PAPISH. Laboratory hours to be arranged. *Baker 396.* Conference, Th 12. *Baker 377.*

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

525. **Special Methods in Optical Chemistry.** First term. Credit two hours. Prerequisite, Chemistry 505. Assistant Professor PAPISH.

Lectures, Assistant Professor PAPISH. F 9. *Baker 377.*

Laboratory, hours to be arranged. *Baker 392.*

Lectures, demonstrations, and laboratory practice. Special optical instruments as applied to the solution of problems arising in the chemical industries and in research; modifications of commonly employed polarimeters, refractometers, nephelometers, colorimeters, etc., as employed in specific industries.

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 31, or special permission. Professor CHAMOT, Dr. MASON, and assistants.

Lecture: Professor CHAMOT. First term, M 12; second term, M 10. *Baker 377.*

Laboratory sections: M T 2-4:30; T Th 10-12:30; Th F 2-4:30. *Baker 378.*

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.

535. **Advanced Chemical Microscopy.** Repeated in the second term. Credit three or more hours. Prerequisite, Chemistry 530. Professor CHAMOT, Dr. MASON, and assistants. Laboratory periods: M T Th F 2-5, T Th 9-1. *Baker 378.* Conference, T 12. *Baker 377.*

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. **Advanced Chemical Microscopy.** Second term. Credit two hours. Prerequisite, Chemistry 530. Professor CHAMOT, Dr. MASON, and assistants. Day and hour to be arranged. *Baker 378.*

Laboratory practice. Organic qualitative microscopic analysis as applied to the detection of common commercial organic compounds, vegetable alkaloids,

"strong drugs," etc., with particular emphasis upon the analysis of minute quantities of material.

In this course work may be elected in the microscopy of textile or paper fibers.

542. **Special Methods in Chemical Microscopy.** Second term. Credit two hours. Prerequisite, Chemistry 530. Professor CHAMOT and Dr. MASON. W F 9. *Baker 377.*

Lectures and demonstrations. A discussion of microscopic methods as applied to the solution of industrial and research problems. Microscopes of special and unusual construction, such as ultramicroscopes, supermicroscopes, luminescence microscopes, long distance microscopes, etc.; their uses and their limitations.

545. **Microscopy of Commercial Alloys.** Second term. Credit two hours. Prerequisite, Chemistry 530, or special permission. Professor CHAMOT, Dr. MASON and assistants. Th F 2-4:30. *Baker 384.*

Laboratory practice. An introduction to the methods employed in the microscopic examination of metals, alloys, and other metallurgical products; practice in grinding, polishing, and etching specimens for microscopic study; metallographic microscopes and their use.

This course may be extended to include other materials of construction.

[550. **Microscopy of Foods and Beverages.** First term. Credit two hours. Prerequisite, Chemistry 530. Professor CHAMOT, Dr. MASON, and assistants. Laboratory hours to be arranged. *Baker 378.* Conference, Th 12. *Baker 377.*

Laboratory practice. The application of microscopic methods to the examination of foods and beverages for the purpose of ascertaining their purity and for the detection of deteriorations, adulterations, and admixtures. Not given in 1926-27.]

[555. **Introductory Photomicrography.** Second term. Credit two or more hours. Prerequisite, Chemistry 530. Professor CHAMOT and Dr. MASON. Day and hour to be arranged. *Baker 382.*

Laboratory practice. Not given in 1926-27.]

595. **Research for Seniors.** Throughout the year. Professor CHAMOT, Assistant Professor PAPISH, and Dr. MASON. See page 5.

SANITARY CHEMISTRY

605. **Introductory Sanitary Chemistry (Foods).** First term. Credit two hours. Prerequisite, Chemistry 305 (or 210, 225 and 375). Dr. GEORGIA. T Th 11. *Baker 377.*

Lectures. Chemistry of foods, beverages, and food accessories; special apparatus; adulteration and misbranding, sweeteners, preservatives, food colors, food poisonings, and methods for their detection. Relation of the chemical composition of materials used in the household to the public health. Garbage disposal.

It is advisable, but not obligatory, that Course 610 accompany this course.

610. **Introductory Sanitary Chemistry (Foods).** First term. Credit two hours. Prerequisite or parallel course, Chemistry 605. Dr. GEORGIA and assistant. Laboratory sections at hours to be arranged. *Baker 352.*

Laboratory practice. Laboratory exercises designed to illustrate the material presented in course 605. General and special methods of analysis of foods, beverages, and food accessories with special reference to the detection of adulteration. The use of saccharimeters, refractometers, cryoscopes, muffle furnaces, vacuum ovens, etc.

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

Lectures. Pollution of water; physical, chemical, bacteriological, and microscopical examination of water for household and municipal purposes; examination of sewage and sewage effluents; introduction to the methods of water purification, water softening, and sewage disposal, and their control. Interpretation of analytical results and the preparation of sanitary surveys.

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. Dr. GEORGIA and assistant. Laboratory sections at hours to be arranged. *Baker* 352.

Laboratory practice. Laboratory exercises designed to illustrate the material presented in Course 615.

[630. Advanced Sanitary Chemistry (Water). First term. Credit two hours. Prerequisite, Chemistry 615. Dr. GEORGIA. T Th 9. *Baker* 377.

Lectures and conferences. Sources of water; methods of water purification, sedimentation, filtration, disinfection; control of water purification; tastes and odors and their control; boiler waters and water softening; iron removal; deactivation of waters; methods of sewage disposal and control.

Laboratory practice to accompany this course may be elected under Course 635. Not given in 1926-27.]

635. Advanced Sanitary Chemistry. Either term. Credit two or more hours. Prerequisite, to be determined in each case by the instructor in charge. Dr. GEORGIA and assistant. Day and hour to be arranged. *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.

Disinfectants, etc.

The work in many cases may be arranged to meet the needs of the individual student.

640. Sanitary Chemistry (Disinfectants). Second term. Credit two hours. Prerequisite, Chemistry 305 (or 375). Dr. GEORGIA. T Th 9. *Baker* 377.

Lectures. Standardization, chemical properties, methods of application, and proper choice of disinfectants and other agents used in combating the spread of disease.

695. Research for Seniors. Throughout the year. Dr. GEORGIA. See page 5.

INDUSTRIAL CHEMISTRY

705. Industrial Chemistry. Throughout the year. Credit three hours a term. Prerequisite, Chemistry 405. Professor RHODES. M W 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 Course 705 in their junior year and to postpone a part of their elective hours until the senior year.

710. Industrial Chemistry. Second term. Credit three hours. Prerequisite, Chemistry 405. Professor RHODES, Dr. JOHNSON, and assistants. Day and hour to be arranged. *Baker* B-78.

Laboratory practice. The study in the laboratory, on a semi-plant scale, of processes and materials used in the chemical industries.

715. Selected Topics in Industrial Chemistry. 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. The lectures in 1926-27 will deal with the theory and design of chemical plant equipment for distillation, evaporation, drying, etc.

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, tar, and the fuel gases. Particular stress is laid upon the theoretical chemistry involved in the carboniza-

tion of coal, the gasification of coal, and the distillation and refining of petroleum and tar.

730. Chemical Plant Design. Repeated in the second term. Credit three hours. Prerequisite, Chemistry 705. Professor RHODES and Dr. JOHNSON. Day and hour to be arranged.

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

***775. Engineering Chemistry.** Repeated in the second term. Credit two hours. Prerequisite, Chemistry 101. Not open to students who are candidates for the degree of Bachelor of Chemistry. Dr. JOHNSON. M W 8. *Baker, Main Lecture Room.*

Lectures. Chemistry in its relation to engineering.

776. Chemistry of Pulp and Paper. Second term. Credit two hours. Prerequisite, Chemistry 775. Open to students in Forestry, to others only by special permission. Dr. JOHNSON. T Th 10. *Baker 177.*

Lectures. The chemistry of the manufacture of pulp and paper.

795. Research for Seniors. Throughout the year. Professor RHODES and Dr. JOHNSON. See page 5.

AGRICULTURAL CHEMISTRY

805. Introductory Agricultural Chemistry (Fertilizers, Insecticides, Soils). First term. Credit two hours. Prerequisite, Chemistry 305 (or 375). Professor CAVANAUGH. T Th 11. *Baker 107.*

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 two hours. Prerequisite, Chemistry 205 and 220 (or 210 and 225). Professor CAVANAUGH, Mr. MISCALL, and assistant. Day and hour to be arranged. *Baker 350.*

Laboratory practice. 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 107.*

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 two hours. Prerequisite, Chemistry 205 and 220 (or 210 and 225). Professor CAVANAUGH, Mr. MISCALL, and assistant. Day and hour to be arranged. *Baker 350.*

Laboratory practice. 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.

835. Advanced Agricultural Chemistry (Fertilizers, Insecticides, Soils). Either term. Credit two or more hours. Prerequisite, Chemistry 810. Professor CAVANAUGH and Mr. MISCALL. 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). Either term. Credit two or more hours. Prerequisite, Chemistry 820. Professor CAVANAUGH and Mr. MISCALL. Day and hour to be arranged. *Baker 350.*

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

***875. 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.

***880. 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.

895. Research for Seniors. Throughout the year. Professor CAVANAUGH. See page 5.

SEMINARY

905. Seminary. Credit one hour. M 5. *Baker 107.*

For seniors who are candidates for the degree of Bachelor of Chemistry.

NON-RESIDENT LECTURESHIP IN CHEMISTRY

1000. Selected Topics in Inorganic Chemistry. First term. Credit two hours. Seniors in the course in Chemistry may elect these lectures, and juniors may do so on special permission. Professor FRITZ PANETH, University of Berlin. T Th 4:30. *Baker 107.*

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.

Issued at Ithaca, New York, twice a month from December to June inclusive, and monthly from July to November inclusive.

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