

# CHEMISTRY

Department Office: 1307 Hunter North; (212) 772-5330

Chair: Gary J. Quigley  
E-mail: gary.quigley@hunter.cuny.edu

Web site: <http://patsy.hunter.cuny.edu/chemistry.html>

Gertrude B. Elion Professor: Goss

**Professors:**

Alexandratos, Dannenberg, Drain, Francesconi, Greenbaum, Grohmann, Massa, Mills, Mootoo, Quigley, Santoro, Sweeney

**Associate Professor:**

Matsui

**Assistant Professors:**

Harding, Kawamura, Kleiman, Krishnamachari, Phillips, Xu

**Adviser:**

Spiro Alexandratos

HEGIS Code: 1905

Majors Offered	Options in Major	Number Credits	Recommended/Required GER	Prereq	Recommended Minor
BA in Chemistry	Major I	41 + 26 cr of math and physics	FL: GERMAN or RUSS	CHEM 102-105 (9 Cr) – or – CHEM 111-112 (11 Cr)	No minor
	Major II option 1: preparation for the chemical industry	26 + 23 cr of math and physics (12 credits of these can be used as the minor)	FL: GERMAN or RUSS	CHEM 102-105 (9 cr) – or – CHEM 111-112 (11 Cr)	Any combination of the required math/physics courses, 12 credits in total (MATH 150 and above; PHYS 110 or above), may be used as a minor. Students may elect a different minor that reflects their interest with the approval of the chemistry adviser
	Major II option 1: QUEST	26 + 23 cr of biology, math and physics	FL: GERMAN or RUSS	CHEM 102-105 (9 cr) – or – CHEM 111-112 (11 Cr)	Childhood education (30 cr.) is collateral major. See School of Education
	Major II option 1: Adolescent Education	26 + 23 cr of biology, math and physics	FL: GERMAN or RUSS	CHEM 102-105 (9 cr) – or – CHEM 111-112 (11 Cr)	Adolescent education (23 cr.) is the appropriate minor. See School of Education
	Major II option 2: biochemistry option for preprofessional students	24 + 30.5 cr of biology, math and physics – or – 27 + 26 cr of biology, math and physics	FL: GERMAN or RUSS	CHEM 102-105 (9 cr) – or – CHEM 111-112 (11 Cr)	Any combination of the required math/physics courses, 12 credits in total (MATH 150 and above; PHYS 110 or above), may be used as a minor. Students may elect a different minor that reflects their interest with the approval of the chemistry adviser
	Major II option 2: QUEST	24 + 26 cr of biology, math and physics – or – 27 + 26 cr of biology, math and physics	FL: GERMAN or RUSS	CHEM 102-105 (9 cr) – or – CHEM 111-112 (11 Cr)	Childhood education (30 cr.) is collateral major. See School of Education
	Major II option 2: Adolescent Education	24 + 26 cr of biology, math and physics – or – 27 + 26 cr of biology, math and physics	FL: GERMAN or RUSS	CHEM 102-105 (9 cr) – or – CHEM 111-112 (11 Cr)	Adolescent education (23 cr.) is the appropriate minor. See School of Education
	Major II option 3: Bioinformatics	21 cr of chemistry, 9 cr of biology, 6 cr of physics, 6 cr of computer science, 6 cr of calculus + 3 cr of statistics	FL: GERMAN or RUSS	CHEM 102-105 (9 cr) – or – CHEM 111-112 (11 Cr)	Any combination of the required math/physics courses, 12 credits in total (MATH 150 and above; PHYS 110 or above), may be used as a minor. Students may elect a different minor that reflects their interest with the approval of the chemistry adviser
BA/MA in Chemistry/Adolescent Education: Chemistry		Minimum 24 cr in chemistry Minimum 29 cr in auxiliary courses Minimum 14 graduate level chemistry cr Total minimum required credits=134	FL: GERMAN or RUSS	Permission of dept.	

The Department of Chemistry offers courses to prepare the science major for professional work and further study in chemistry and other fields of pure and applied science. Courses for the non-science major are designed to present those essentials of chemical fact and theory which will contribute to the student's understanding of present-day scientific knowledge.

## MAJOR

There are two chemistry majors: Major I, a 41-credit concentration in addition to a 9-credit general chemistry core, is designed to prepare the students with intensive training for professional research and graduate study. Major II consists of three options: Option 1 for students interested in the chemical industry; Option 2 (the biochemistry option) for students interested in the pharmaceutical industry, medicine, dentistry, veterinary medicine or physical therapy; Option 3 (bioinformatics option) for students interested in graduate studies in biochemistry and bioinformatics as well as pharmaceutical and biotechnology industry. Major II includes a minimum concentration of 26-credits (option 1), 24-credits (option 2), and 21-credits (option 3) in 200-level and above chemistry courses, in addition to a 9-credit general chemistry core. Options 1-3 are all appropriate for students pursuing teacher education programs.

Students considering a chemistry major should consult the departmental adviser during their first semester to plan the proper sequence of courses, and they are urged to consult with the adviser at least once each succeeding semester. General Chem lecture I and II and General Chem Labs 1 and 2 are prerequisites for admission to both Major I and Major II.

### Chemistry Major I

**General Chemistry Core:** CHEM 102-105 or CHEM 111-113.

The requirements for this major consist of 41 credits in chemistry. There is no allied minor. This major is recommended for students preparing for admission to graduate school or for

careers in chemical research. It will also be useful to students seeking a position in the chemical or allied industries, as it is accredited by the Committee on Professional Training of the American Chemical Society.

The 41-credit major consists of CHEM 222-223, 224-225, 249, 349, 352, 354 or 356 with 355, 357, 366, 376 and 390. One further laboratory course must be chosen from 291.02 (research), 491.02 (honors research) or 378. In addition, one additional lecture course must be chosen from among the following: CHEM 322, 345, 354, 356, or 377. Also acceptable for completion of Major I are PHYS 330, PHIL 362 or 379. Students should be aware, however, that if either of the philosophy courses is used to complete the Major I requirements, the major will not be eligible for accreditation by the American Chemical Society. One year of physics, PHYS 111 and 121, and four semesters of mathematics, MATH 150, 155, 250 and 254 or 260 are also required for this major; CHEM 249, MATH 150 and 155, and PHYS 121 are prerequisites for CHEM 352 and should be completed by the end of the sophomore year. College Russian or German sufficient to meet Hunter's GER requirement in foreign languages is recommended.

Major I is required of all students who wish to be considered for certification by the American Chemical Society upon graduation. It is recommended for all students intending to enter the profession of chemistry through either graduate study or employment in industry or government. Students who can attend only in the evenings should consult the department adviser regarding the feasibility of completing Chemistry Major I.

## Chemistry Major II

**General Chemistry Core:** CHEM 102-105 or CHEM 111-112.

### Option 1:

For students interested in a career in the chemical industry. It consists of a minimum of 26 credits in chemistry above the introductory level and a 9 to 11 credit general chemistry core for a total of 35-37 credits of chemistry. One year of physics and three semesters of calculus are also required for Major II.

Required chemistry courses: CHEM 222-225, 249, 352, 354, or 356, 355, and 357

Required elective course: Any chemistry course at the 300 level or above.

Required allied courses: MATH 150, 155, 250, and PHYS 111, 121

### Option 2 (Biochemistry option):

For students preparing for admission to medical, dental, veterinary schools or physical therapy programs, or for students interested in a career in the pharmaceutical industry. It consists of a minimum of 24 credits above the introductory level and a 9-11 credit general chemistry core for a total of 33-35 credits of chemistry. One year of physics, one year of biology and one year of calculus are also required.

Required chemistry courses: CHEM 222-225, 350, 376-378

Required elective course: Any chemistry course at the 200-level or above (excluding CHEM 291 and 295) or BIOL 200 or 202

Required allied courses: BIOL 100, 102, MATH 150, 155, and PHYS 110, 120

### Option 2 (Bioinformatics option):

For students interested in graduate studies in biochemistry and bioinformatics as well as pharmaceutical and biotechnology industry. In order to enroll in this Option, students must earn an average grade of B- or above in CHEM 104, 222, BIOL 100, and MATH 150. In addition, no more than one C grade is allowed in these four courses to declare Option 3. This option consists of a minimum of 21-credits above the introductory level and a 9-credit general chemistry core for a total of minimum 30 credits of chemistry. Three semesters of biology, one year of physics, one year of computer science, one year of calculus, and one semester of statistics are also required.

Required chemistry courses: CHEM 222-225, 350, 376, and 377

Required elective courses: Minimum 3 credits from any Quantitative Biology (QuBi) elective courses (CHEM 388, STAT 319, AN-P 302 and BIOL 471)

Required allied courses: BIOL 100, 102, 425, MATH 150, 155, PHYS 110, 120, CSCI 132, 232, and STAT 213



**Minors for Major II**

Any combination of the required physics and math courses, totaling 12 credits, may be used as a minor. If students prefer to elect a different minor, they must consult with the department adviser or chair.

**Minor for Non-Majors**

For chemistry as a minor, the recommended sequence is either CHEM 102-105 (9 credits) or CHEM 111-112 (11 credits), followed by any course at the 200 level (excluding 291 and 295).

**HONORS WORK**

Opportunity for an individual research experience is provided by an honors course, CHEM 491 (Introduction to Research).

**ELECTIVES**

Advanced lecture courses in special areas of chemistry, and lab courses providing training in inorganic and organic chemistry and in research techniques, are offered as electives for Major I and are open to students enrolled in Major II who have fulfilled the course prerequisites.

**GRADUATE STUDY**

Qualified chemistry majors may be admitted to 700-level courses in the graduate program. Permission of the department is required.

**PREPARATION FOR TEACHING**

In cooperation with the School of Education, the Department of Chemistry provides opportunities for students to prepare for careers in teaching at the elementary and secondary level in the area of chemistry. Chemistry Major II, Option I (35 credits) and Option 2 (33 credits) both satisfy the requirements for New York State certification for teachers of chemistry in Childhood Education (Grades 1-6) and Adolescent Education (Grades 7-12). For students pursuing certification as chemistry teachers at the secondary level, the 23-credit adolescent education sequence is an appropriate minor. Students who want to qualify for New York City licensing and New York State certification for teaching in secondary schools should consult the Education section of this catalog for additional requirements.

**Five-Year BA/MA Degree in Chemistry and Adolescent Education: Chemistry**

An accelerated program leading to a BA in Chemistry and an MA in Adolescent Education: Chemistry. Undergraduates admitted to the program start graduate courses during their senior year and will be able to complete the MA degree one year after they complete the requirements for the BA degree. Students interested in the program should speak to a chemistry department adviser during their sophomore year to review the curriculum path for the five-year program. A minimum of 134 credits is required for the dual degree.

**COURSE LISTINGS**

*Note: No student may receive credit for both CHEM 100-101 and 102-103 or 111; no student may receive credit for both CHEM 120-121 and 222-223.*

**CHEM 100 Essentials of General Chemistry Lecture**  
GER 2/E

Essential facts, laws, and theories of general chemistry. *Note: Core credit awarded only if CHEM 100 and CHEM 101 are completed. Primarily for nursing, nutrition and food science and community health education students.*  
4 hrs (3 lec, 1 rec), 3 cr.

**CHEM 101 Essentials of General Chemistry Laboratory**  
GER 2/E

Experiments designed to illustrate fundamental laws and techniques of general chemistry. *Note: Core credit awarded only if CHEM 100 and CHEM 101 are completed. Primarily for nursing, nutrition and food science and community health education students.*  
*pre- or coreq:* CHEM 100  
4 hrs (3 lab, 1 rec), 1.5 cr.

**CHEM 102 General Chemistry I**  
GER 2/E

In-depth introduction to stoichiometric calculations, atomic and molecular structure and chemical bonding. *Note: Core credit awarded only if CHEM 102 and CHEM 103 are completed. Primarily for pre-med, medical laboratory sciences and science majors.*  
*pre- or coreq:* MATH 125, 126 or equiv.  
4 hrs (3 lec, 1 rec), 3 cr.

**CHEM 103 General Chemistry Laboratory I**  
GER 2/E

Study of experiments designed to illustrate fundamental laws and techniques of chemistry. *Note: Core credit awarded only if CHEM 102 and CHEM 103 are completed. Primarily for pre-med, medical laboratory sciences and science majors.*  
*pre- or coreq:* CHEM 102  
4 hrs (3 lab, 1 rec), 1.5 cr.

**CHEM 104 General Chemistry II**  
GER 2/E

In-depth introduction to thermodynamics, redox reactions, electrochemistry and chemical equilibrium. *Note: Core credit awarded only if CHEM 104 and CHEM 105 are completed. Primarily for premed, medical laboratory sciences and science majors.*  
*prereqs:* CHEM 102 and 103 or CHEM 100 with perm chair  
4 hrs (3 lec, 1 rec), 3 cr.

**CHEM 105 General Chemistry Laboratory II**  
GER 2/E

Laboratory experiments illustrating and applying theory of solutions to qualitative analysis. *Note: Core credit awarded only if CHEM 104 and CHEM 105 are completed. Primarily for pre-med, medical laboratory sciences and science majors.*  
*prereq:* CHEM 103  
*pre- or coreq:* CHEM 104  
4 hrs (3 lab, 1 rec), 1.5 cr.

**CHEM 106 General Chemistry Laboratory**  
GER 2/E

Experiments designed to illustrate the fundamental laws of chemistry. The course is equivalent to CHEM 103 and CHEM 105 and constitutes one year of general chemistry laboratory. Credit not given for CHEM 106 and CHEM 103 or CHEM 105. *Primarily for pre-med, medical laboratory sciences and science majors.*  
*pre- or coreq:* CHEM 104  
8 hrs (6 lab, 2 rec), 3 cr. (Pending approval of Faculty Senate)

**CHEM 111 Chemical Principles**  
GER 2/E

In-depth introduction to chemical principles including measurement, stoichiometric calculations, inorganic nomenclature, gas laws, equilibrium, acids, bases and buffers. Emphasis is placed on problem-solving, oral presentations, and collaborative work. Laboratory and coursework emphasize analysis and evaluation of data. *Primarily for pre-med, medical laboratory sciences and science majors.*  
*pre- or coreqs:* MATH 125 or equiv, MATH 126  
10 hrs (4 hrs lec, 3 hrs lab, 1 hr rec, 2 hrs workshop), 5.5 cr.  
offered fall

**CHEM 112 Thermodynamics and Solution Chemistry**  
GER 2/E

The study of quantum theory, atomic structure, periodic properties of the elements, kinetics, electrochemistry, and thermodynamics. *Primarily for pre-med, medical laboratory sciences and science majors*  
*prereq:* CHEM 111  
10 hrs (4 hrs lec, 3 hrs lab, 1 hr rec, 2 hrs workshop), 5.5 cr.  
offered spring

**CHEM 115 Introductory Chemistry**

An introduction to the fundamental concepts in chemistry including atomic and molecular structure, chemical bonding, stoichiometry, and solution chemistry. This course is appropriate for students who have had no prior coursework in chemistry.  
*pre- or coreq:* MATH 125  
4 hrs (3 lec, 1 rec), 3 cr.

**CHEM 120 Essentials of Organic Chemistry Lecture**

GER 2/E

Course presents essential facts, laws and theories of organic chemistry. *Note: Core credit awarded only if CHEM 120 and CHEM 121 completed. Primarily for nursing, nutrition and food science and community health education students.*

prereq: CHEM 100

4 hrs (3 lec, 1 rec), 3 cr.

**CHEM 121 Essentials of Organic Chemistry Laboratory**

GER 2/E

Experiments designed to illustrate fundamental laws and techniques of organic chemistry. *Note: Core credit awarded only if CHEM 120 and CHEM 121 completed. Primarily for nursing, nutrition and food science and community health education students.*

prereq: CHEM 101

pre- or coreq: CHEM 120

4 hrs (3 lab, 1 rec), 1.5 cr.

**CHEM 150 Peer-Led Teaching in Chemistry**

Students learn to become peer-leaders for workshops held in either Essentials of Chemistry, General Chemistry, or Organic Chemistry Topics include: multiple intelligences and differences in learning styles; basic theory of learning; issues related to race, class and gender.

prereq: CHEM 120, CHEM 104, or CHEM 112 and perm dept.

2 hrs, 1 cr.

**CHEM 222, 224 Organic Chemistry Lectures I and II**

GER 3/B

Structure, bonding, and reactions of organic molecules. Synthesis, stereochemistry, spectroscopy, reaction mechanisms.

prereq for CHEM 222: CHEM 104

prereq for CHEM 224: CHEM 222

4-6 hrs (3 lec, 1-3 recitation/workshop), 3 cr. each

**CHEM 223 Organic Chemistry Laboratory I**

GER 3/B

Various organic syntheses, crystallization, distillation, extraction, chromatography, qualitative analysis, spectroscopy.

prereq: CHEM 105

pre- or coreq: CHEM 222

5 hrs, 2.5 cr.

**CHEM 225 Organic Chemistry Laboratory II**

GER 3/B

Continuation of CHEM 223.

prereqs: CHEM 222, 223

pre- or coreq: CHEM 224

5 hrs, 2.5 cr.

**CHEM 249 Quantitative Analysis**

GER 3/B

A set of laboratory experiments, performed by individual students, covering important areas of quantitative analysis such as pH and metal ion titrations, spectroscopic analysis including gas chromatography, electronic absorption, and fluorescence.

prereqs: CHEM 104, 105

5 hrs (4 lab, 1 rec), 3 cr.

offered fall

**CHEM 291 Chemical Investigations**

GER 3/B

Original chemical investigations under supervision of faculty member. Written report required. Enrollment for maximum of two semesters.

prereqs: CHEM 224, perm chair

4 hrs, 1 cr. or 8 hrs, 2 cr.

**CHEM 295 Introduction to Planning and Teaching of Laboratory Work in Chemistry**

Participate in supervised teaching experiments that demonstrate important principles of chemistry.

prereqs: CHEM 104, CHEM 105, two letters from faculty who have taught the student

5 hrs (2 planning, 3 lab), 2 cr.

**CHEM 322 Organic Chemistry Lecture III**

GER 3/B

Selected topics such as advanced synthesis, reaction mechanisms, MO theory, natural products, NMR spectroscopy.

prereqs: CHEM 224, perm instr.

3 hrs, 3 cr.

**CHEM 349 Instrumental Analysis**

GER 3/B

Principles of modern instrumental techniques; emphasis on spectroscopic and electrometric methods.

prereq: CHEM 354 or 356 with 355

8 hrs (2 lec, 6 lab), 5 cr.

offered fall

**CHEM 350 Biophysical Chemistry**

GER 3/B

Essential physical chemical principles as applied to biological problems. Emphasis on kinetics, thermodynamics, and equilibria.

prereqs: CHEM 224, BIOL 102, MATH 150

4 hrs, 4 cr.

offered fall

**CHEM 352 Physical Chemistry I**

GER 3/B

Ideal and real gases. Laws of thermodynamics with applications to properties of solutions and phase equilibria in general.

prereqs: CHEM 249, MATH 155, PHYS 121

3 hrs, 3 cr.

offered fall

**CHEM 354 Physical Chemistry II - F**

GER 3/B

Selected topics from statistical thermodynamics, electrochemistry, kinetic theory and rate processes.

prereqs: CHEM 352, MATH 250

3 hrs, 3 cr.

offered fall

**CHEM 355 Physical Chemistry Laboratory I**

GER 3/B

Laboratory course involving experiments based on topics covered in CHEM 352 on chemical systems.

prereq: CHEM 249

pre- or coreq: CHEM 352

3 hrs, 1.5 cr.

offered fall

**CHEM 356 Physical Chemistry II - S**

GER 3/B

Selected topics from quantum chemistry, molecular structure, and spectroscopy.

prereqs: PHYS 121, CHEM 249, MATH 155

3 hrs, 3 cr.

offered spring

**CHEM 357 Physical Chemistry Laboratory II**

GER 3/B

Laboratory course involving experiments based on topics covered in CHEM 356 on chemical systems.

prereq: CHEM 249 or perm chair

pre- or coreq: CHEM 356

3 hrs, 1.5 cr.

offered spring

**CHEM 366 Inorganic Chemistry**

GER 3/B

Treatment of structure, bonding and reactivity of inorganic compounds.

prereq: CHEM 352

3 hrs, 3 cr.

offered fall

**CHEM 376 Biochemistry I**

GER 3/B

Chemical aspects of protein structure and function, fundamentals of bioenergetics, biochemical mechanisms of gene replication and expression.

prereq: CHEM 224

3 hrs, 3 cr.

offered fall

**CHEM 377 Biochemistry II**

GER 3/B

Biosynthesis of lipids, amino acids, carbohydrates. Muscle contraction, hormones, immune response, DNA sequencing.

prereq: CHEM 376 or BIOL 300 or perm instr.

3 hrs, 3 cr.

offered spring

**CHEM 378 Biochemistry Laboratory**

GER 3/B

A set of laboratory experiments, performed by individual students, covering important areas of biochemistry such as protein analysis, enzyme purification, enzymatic assays, recombinant DNA and the polymerase chain reaction.

prereqs: CHEM 223 and CHEM 376 or CHEM 640

5 hrs (4 lab, 1 rec), 3 cr.

**HONORS COURSE****CHEM 491 Introduction to Research**

GER 3/B

Open to Jr/Sr only. Similar to CHEM 291.

Written report required. Fulfills requirement for departmental honors course.

prereqs: CHEM 224, 354, 349, perm chair

4 hrs, 1 cr. or 8 hrs, 2 cr.