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LaGrange College

Course Catalog - Chemistry

B.A. in Chemistry - B.A. in Chemistry

Type: Major

Learning Objectives: Bachelor of Arts Degree in Chemistry

Students who earn the Bachelor of Arts degree with a major in Chemistry will be appropriately competent in: core topics in chemistry, the language of chemistry, and an appropriate selection of the following laboratory skills and advanced studies.

Core Topics:

- atomic and molecular structure and chemical bonding
- equilibria and stoichiometry
- thermochemistry
- periodic relationships
- thermodynamics
- chemical dynamics
- quantum mechanics and spectroscopy
- recognition, structure, and reactivity of the major organic functional groups

Language of Chemistry:

- verbal, written, numerical and graphical communication of chemical concepts
- use of the chemical literature
- knowledge of the research process

Laboratory Skills:

- data organization and analysis
- use of analytical instrumentation
- volumetric and gravimetric analytical theory and practice
- techniques in biotechnology
- synthesis and characterization of organic compounds by physical and instrumental methods

Advanced Studies:

- analytical instrumentation theory and application
- advanced inorganic chemistry,
- advanced organic chemistry

- biochemistry: biological molecules and metabolism

Assessment of Learning Objectives

Students who earn the B.A. degree will have demonstrated their attainment of the specific objectives by appropriate scores on the current American Chemical Society (ACS) Exams for (1) General Chemistry and (2) Organic Chemistry. The passing score will be at or above the 40th percentile of the national norms for these exams or at an appropriate level, as determined by the Department of Chemistry, based on the accumulated data of the performance of LaGrange College students on these exams. The results that are in the best interest of the students will be used. These exams will be given at the end of the appropriate courses and will be offered to students up to three (3) additional times prior to the time of the student's scheduled graduation. The student must attempt a retest at least once a semester until successful completion of the exam. In the event that a student needs to repeat an exam for the second, third, or final time, evidence of preparation must be presented. Reexamination cannot be scheduled earlier than two (2) weeks following a previous examination.

Requirements for the Bachelor of Arts Degree in Chemistry

Students earn these competencies by pursuing the following Bachelor of Arts curriculum in Chemistry:

CHEM 1101, 1102	General Chemistry	8 semester hour
CHEM 3201, 3202	Organic Chemistry	8 semester hour
CHEM 2251	Analytical Chemistry	4 semester hour
CHEM 3311	Elements of Physical Chemistry	3 semester hour
CHEM 3371	Junior Seminar	1 semester hour
CHEM 4471	Senior Seminar	2 semester hour
Chemistry electives		6-8 semester ho

Chemistry electives are normally 3000 or 4000 level classes in chemistry, but coursework outside of the chemistry may be substituted with approval of the major's chemistry advisor.

Required supporting courses include the following:

PHYS 1101, 1102 or 2121, 2122	8 semester hours
MATH 1221	4 semester hours
Total: 44-46 semester hours	

The **scheduling** of the courses for the B.A. in Chemistry can be somewhat flexible. Students are urged to seek advisement from a faculty member in the chemistry program prior to or early in their first semester. The following are possible sequences to fulfill the requirements for the major:

	Fall	**Spring**
First Year	CHEM 1101	CHEM 1102

	MATH 1221	
Second Year	CHEM 3201	CHEM 3202
	PHYS 1101 or 2121	PHYS 1102 or 2122

Junior- and senior-year sequence depends on which years Analytical Chemistry (CHEM2251) and Elements of Physical Chemistry (CHEM3311) are being offered.

Third Year	CHEM elective	CHEM 3311
		CHEM 3371
Fourth Year	CHEM 2251	CHEM elective
		CHEM 4471
OR:		
Third Year	CHEM 2251	CHEM elective
		CHEM 3371
Fourth Year	CHEM elective	CHEM 3311
		CHEM 4471

Students may substitute CHEM 3301 and CHEM 3302 (Physical Chemistry) for CHEM3311 (Elements of Physical Chemistry) and one upper level elective.

Pre-Professional Students should meet with the appropriate Pre-Professional Advisor as well as a faculty member of the Chemistry Program to plan their schedules.

B.S. in Chemistry - B.S. in Chemistry

Type: Major

Learning Objectives: Bachelor of Science Degree in Chemistry

Students who earn the B.S. degree with a major in Chemistry will be appropriately competent in: core topics in chemistry, the language of chemistry, and an appropriate selection of the following laboratory skills and advanced studies.

Core Topics:

- atomic and molecular structure and chemical bonding
- equilibria and stoichiometry
- thermochemistry
- periodic relationships
- thermodynamics
- chemical dynamics
- quantum mechanics and spectroscopy
- recognition, structure, and reactivity of the major organic functional groups

Language of Chemistry:

- verbal, written, numerical and graphical communication of chemical concepts
- use of the chemical literature
- knowledge of the research process

Laboratory Skills:

- data organization and analysis
- use of analytical instrumentation
- volumetric and gravimetric analytical theory and practice
- techniques in biotechnology
- synthesis and characterization of organic compounds by physical and instrumental methods

Advanced Studies:

- analytical instrumentation theory and application
- advanced inorganic chemistry,
- advanced organic chemistry
- biochemistry: biological molecules and metabolism

Assessment of Learning Objectives

Students who earn the B.S. degree will have demonstrated their attainment of the specific objectives by appropriate scores on the current American Chemical Society (ACS) Examinations on the following three (3) topics: General, Organic, and Physical. The students will additionally attain an appropriate score from one (1) of the following examinations: Analytical, Instrumental, Inorganic, or Biochemistry. The passing score will be at or above the 40th percentile of the national norms for these exams or at an appropriate level, as determined by the Department of Chemistry, based on the accumulated data of the performance of LaGrange College students on these exams. The results that are in the best interest of the students will be used. These exams will be given at the end of the appropriate courses and will be offered to students up to three (3) additional times prior to the time of the student's scheduled graduation. The student must attempt a retest at least once a semester until successful completion of the exam. In the event that a student needs to repeat an exam for the second, third, or final time, evidence of preparation must be presented. Reexamination cannot be scheduled earlier than two (2) weeks following a previous examination.

Requirements for the Bachelor of Science Degree in Chemistry

Students earn these competencies by pursuing the following Bachelor of Science curriculum in Chemistry:

CHEM 1101, 1102 General Chemistry	8 semester hours
CHEM 3201, 3202 Organic Chemistry	8 semester hours

CHEM 2251 Analytical Chemistry	4 semester hours
CHEM 3301, 3302 Physical Chemistry	8 semester hours
CHEM 3371 Junior Seminar	1 semester hours
CHEM 4451 Instrumental Analysis	4 semester hours
CHEM 4471 Senior Seminar	2 semester hours
CHEM elective (3000 or 4000 level)	3-4 semester hours

Additionally, a **research experience** is required. This should be taken between the junior and senior years or during the first semester or January Term of the senior year. This may be accomplished on campus, in industry, or in a research university summer program. Students may elect to earn CHEM 4900 credit for this required activity.

Supporting required courses include the following:

MATH 2221, 2222 Calculus I and II	8 semester hours
PHYS 2121, 2122 General Physics I and II (calculus-based physics)	8 semester hours

Total: 56 semester hours + research experience

Students are urged to seek advisement from a faculty member in the chemistry program prior to or early in their first semester. The **scheduling** of the B.S. curriculum is important, as the Physical Chemistry sequence (CHEM 3301and 3302) alternates years with Analytical Chemistry (CHEM 2251) and Instrumental Analysis (CHEM 4451). To be prepared to take the Physical Chemistry sequence, students should take Calculus during the first year and Physics during the sophomore year. It is highly recommended that students take General Chemistry during their first year. The following would be typical sequences of courses for the B.S. Chemistry degree:

	Fall	**Spring**
First year	CHEM 1101	CHEM 1102
	MATH 2221	MATH 2222
Second Year	CHEM 3201	CHEM 3202
	PHYS 2121	PHYS 2122

Junior- and senior-year sequence depends on which year Physical Chemistry and Instrumental Analys being offered.

Third Year	CHEM 3301	CHEM 3302
		CHEM 3371
Fourth Year	CHEM 2251	CHEM 4451
		CHEM 4471
	CHEM elective or	CHEM elective

OR:

Third Year	CHEM 2251	CHEM 4451
		CHEM 3371
Fourth Year	CHEM 3301	CHEM 3302
		CHEM 4471
	CHEM elective or	CHEM elective

Minor in Chemistry - Minor in Chemistry

Type: Minor

A **minor** in Chemistry shall consist of General Chemistry I & II (CHEM 1101 & 1102) , Organic Chemistry I & II (CHEM 3201 & 3202) and two (2) additional Chemistry courses from the following:

Analytical Chemistry (CHEM 2251), Physical Chemistry (CHEM 3301, 3302 or 3311), Inorganic Chemistry (CHEM 3331), Advanced Organic Chemistry (CHEM 4201), Biochemistry (CHEM 4421, 4422) or Instrumental Analysis (CHEM 4451)

Pre-professional students should consider Advanced Organic Chemistry, Instrumental Analysis and Biochemistry as their options.

Total: 22-24 semester hours

Students must also demonstrate proficiency in general chemistry by passing the ACS General Chemistry Examination as stated above.

CHEM 1005 - Survey of Chemistry

Selected topics in General Chemistry, Organic Chemistry and Biochemistry are studied during this one semester course. Topics will include chemical equations, stoichiometry, chemical nomenclature, functional groups, and classification of biological molecules with a focus on enzymes. The course is appropriate for exercise science or allied health students where no further chemical study is anticipated.

Grade Basis: L
Credit hours: 3.0
Lecture hours: 3.0

Prerequisites:

- MATH 1101 - College Algebra

Restrictions:

- MATH 1101 or placement into MATH 1221

CHEM 1101 - General Chemistry I

A study of the foundations of chemistry, including stoichiometry, atomic structure and periodicity, molecular structure and bonding models, and thermochemistry.

Grade Basis: L
Credit hours: 4.0

Lecture hours: 4.0

Prerequisites:

- MATH 1101 - College Algebra

Restrictions:

- Offered in Fall terms
- MATH 1101 or placement into MATH 1221

CHEM 1102 - General Chemistry II

A continuation of CHEM 1101; a study of the gas, liquid, and solid phases, chemical thermodynamics, kinetics, general equilibria, acid/base equilibria, oxidation-reduction reactions, and electrochemistry.

Grade Basis: L
Credit hours: 4.0
Lecture hours: 4.0

Prerequisites:

- CHEM 1101 - General Chemistry I

Restrictions:

- Offered in Spring terms

CHEM 2251 - Analytical Chemistry

A study of the theory and practice of quantitative analysis. This course will cover methods that include gravimetric, titrimetric, compleximetric and redox methods for analysis of samples. It will also include topics on sampling, standardization and statistical treatment of data and error. A special emphasis will be placed on aqueous equilibria and acid-base methods. Laboratory exercises complimentary to these topics will be included.

Grade Basis: L
Credit hours: 4.0
Lecture hours: 4.0

Prerequisites:

- CHEM 1102 - General Chemistry II

Restrictions:

- Offered in Fall terms (Odd Years)

CHEM 3201 - Organic Chemistry I

A study of the fundamentals of organic chemistry with respect to the bonding, structure, nomenclature, and reactivity of various classes of organic compounds, including aromatic compounds.

Grade Basis: L
Credit hours: 4.0
Lecture hours: 4.0

Prerequisites:

- CHEM 1102 - General Chemistry II

Restrictions:

- Offered in Fall terms

CHEM 3202 - Organic Chemistry II

A continuation of CHEM 3201, including spectroscopy, synthesis, carbonyls, and biomolecules.

Grade Basis: L
Credit hours: 4.0
Lecture hours: 4.0

Prerequisites:

- CHEM 3201 - Organic Chemistry I

Restrictions:

- Offered in Spring terms

CHEM 3301 - Physical Chemistry: Thermodynamics and Chemical Kinetics.

A study of the basic principles of physical chemistry, including the properties of gases, kinetic theory of gases, thermodynamics, thermochemistry, changes of state, phase rules, electrochemistry, and chemical kinetics.

Grade Basis: L
Credit hours: 4.0
Lecture hours: 4.0

Prerequisites:

- CHEM 3202 - Organic Chemistry II
- MATH 2222 - Analytic Geometry and Calculus II

- PHYS 1101 - Introductory Physics I

Restrictions:

- Offered in Fall terms (Even Years)
- Permission of instructor may replace CHEM 3202 as a prerequisite
- PHYS 2121 may replace PHYS 1101 as a prerequisite

CHEM 3302 - Physical Chemistry: Chemical Dynamics and Quantum Mechanics.

The study of basic principles of physical chemistry, focusing on gas kinetics, chemical dynamics, quantum mechanics, and atomic and molecular spectroscopy.

Grade Basis: L
Credit hours: 4.0
Lecture hours: 4.0

Prerequisites:

- MATH 2222 - Analytic Geometry and Calculus II
- PHYS 1102 - Introductory Physics II
- PHYS 2122 - General Physics II

Restrictions:

- Offered in Spring terms (Odd Years)

CHEM 3311 - Elements of Physical Chemistry

An overview of thermodynamics, chemical dynamics, and quantum chemistry taught at the algebra level and including applications to biological systems.

Grade Basis: L
Credit hours: 3.0
Lecture hours: 3.0

Prerequisites:

- CHEM 3202 - Organic Chemistry II
- MATH 1221 - Precalculus
- PHYS 1101 - Introductory Physics I

Restrictions:

- Offered in Spring terms (Even Years)
- Permission of instructor may replace CHEM 3202 as prerequisite
- MATH 1221 or placement in MATH 2221
- PHYS 2121 may replace PHYS 1101 as pre-requisite

CHEM 3331 - Inorganic Chemistry

An in-depth examination of atomic and molecular structure with a focus on inorganic molecules and complexes. Point Group Symmetry concepts will be introduced and applied.

Grade Basis: L
Credit hours: 3.0
Lecture hours: 3.0

Prerequisites:

- CHEM 3201 - Organic Chemistry I

Restrictions:

- Offered in Spring terms (Odd Years)

CHEM 3371 - Junior Seminar

A course that acquaints the student with the chemical literature as well as presentation and discussion of scientific data and information. In addition, students explore career opportunities, prepare a portfolio, and develop career plans.

Grade Basis: P
Credit hours: 1.0
Lecture hours: 1.0

Restrictions:

- Offered in Spring terms
- Must be of junior standing

CHEM 4201 - Advanced Organic Chemistry

CHEM4201 is an extension of the study of organic chemistry as begun in the CHEM3201-3202 series, with the addition of special topics of interest for organic chemists not covered in that series.

Grade Basis: L
Credit hours: 3.0
Lecture hours: 3.0

Prerequisites:

- CHEM 3202 - Organic Chemistry II

Restrictions:

- Offered in Fall terms

CHEM 4421 - Biochemistry I

An introductory course in the principles of biochemistry, with emphasis on the structure and function of biomolecules, membrane structure and function, and an introduction to metabolism and bioenergetics.

Grade Basis: L
Credit hours: 4.0
Lecture hours: 3.0
Lab hours: 3.0

Prerequisites:

- CHEM 3202 - Organic Chemistry II

Restrictions:

- Offered in Fall terms

CHEM 4422 - Biochemistry II

A continuation of CHEM 4421, with emphasis on cellular metabolism, fundamentals of molecular genetics, and current topics in biochemistry.

Grade Basis: L
Credit hours: 4.0
Lecture hours: 3.0
Lab hours: 3.0

Prerequisites:

- CHEM 4421 - Biochemistry I

Restrictions:

- Offered in Spring terms

CHEM 4451 - Instrumental Analysis

A study of the basic instrumentation used for the quantitative and qualitative analysis of organic and inorganic compounds. This course examines the major instrument types used for this purpose, highlighting instrument design and operation, sampling and the interpretation of output.

Grade Basis: L
Credit hours: 4.0

Lecture hours: 3.0
Lab hours: 3.0

Prerequisites:

- CHEM 3201 - Organic Chemistry I

Restrictions:

- Offered in Spring terms (Even Years)

CHEM 4471 - Senior Seminar

A capstone course that is thematic. Emphasis is on integration of the student's experience in chemistry and the presentation of chemical literature in seminar and written form.

Grade Basis: L
Credit hours: 2.0
Lecture hours: 2.0

Restrictions:

- Offered in Spring terms
- Senior Standing

CHEM 4800 - Special Topics

A "special topic" course that may be designed to provide the student with exposure to topics and concepts not covered in the regular course offerings.

Grade Basis: L
Credit hours: 1.0
Lecture hours: 1.0

Restrictions:

- Offered on demand
- 1-4 Credit Hours

CHEM 4900 - Independent Study

This course can vary and may be used to satisfy the research requirement for the B.S. major and provide research experience for B.A. majors.

Grade Basis: L
Credit hours: 1.0
Lecture hours: 1.0

Restrictions:

- Offered on demand
- 1-4 Credit Hours

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