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Chemistry

Saint Mary's College of California

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CHEMISTRY

The Chemistry Department seeks to offer a versatile academic program that will prepare students for a variety of options upon graduation: employment in industry, graduate work in chemistry or related fields, entry into professional schools such as medicine or dentistry, or teaching at the K–12 level. Using a balance of theoretical and experimental work, the curriculum attempts to provide students with a solid understanding of fundamental concepts, the ability to reason through unfamiliar problems, the tools to investigate a topic in depth and the communication skills that are needed to share information with others.

The department recognizes that since chemistry is a discipline whose primary focus is the underlying substances of the universe, it is important both independently and in relation to other fields of study. For these reasons the department strives to connect the curriculum to other disciplines and real-world examples whenever possible, and to routinely offer courses to meet the needs of students who are not science majors.

FACULTY

Kenneth J. Brown, Ph.D., *Professor*
Steven J. Bachofer, Ph.D., *Professor*
Debjani Bhaduri, Ph.D., *Adjunct Professor*
Valerie A. Burke, Ph.D., *Associate Professor*
Joel D. Burley, Ph.D., *Professor*
John S. Correia, Ph.D., *Professor Emeritus*
Patricia Jackson, Ph.D., *Adjunct Professor*
Mark Lingwood, Ph.D., *Assistant Professor*
Karen M. Ruff, Ph.D., *Assistant Professor*
Michelle L. Shulman, Ph.D., *Associate Professor*
Jeffrey A. Sigman, Ph.D., *Professor*
Zuleikha Kurji, Ph.D., *Assistant Professor*

LEARNING OUTCOMES

The learning outcomes for the Chemistry Department are organized into five general categories:

- **TOOLS** for learning
- **FUNDAMENTAL** knowledge and conceptual understanding
- **INVESTIGATIVE** skills
- **COMMUNICATION** skills
- **SOCIETAL AWARENESS** and concerns

PREPARATION FOR SUCCESS

Students planning a major in chemistry should present credits for one year of chemistry, one year of physics, and four years of mathematics, and should have at least a B average in these subjects. Students with a good high school record but lacking credit in any of these subjects should remedy any deficiencies in summer school. Students planning a science major should be particularly alert to the language proficiency requirement (see Program of Study) and the math diagnostic prerequisite for entrance into **Chem 8**.

MAJOR REQUIREMENTS

The Chemistry Department offers several options for the student interested in chemistry:

- (1) the standard chemistry major
- (2) the chemistry major with an environmental concentration
- (3) the biochemistry major (offered jointly with the Biology Department; see Biochemistry major for more information)

A suggested four-year program of study for a major in chemistry or biochemistry is available from any Chemistry Department faculty member.

LOWER DIVISION

The following lower-division courses are required for the two majors in chemistry: **Chemistry 8, 9 (lab), 10, 11 (lab), 89; Mathematics 27, 38**. Each major has additional lower-division requirements as follows:

- For the standard chemistry major, students must also take **Mathematics 39** and **Physics 1, 2 (lab), 3, 4 (lab)**.
- For the chemistry major—environmental concentration, students must also take: **Physics 1, 2 (lab), 3, 4 (lab)** or **Physics 10, 20 (lab), 11, 21 (lab)**; and **Biology 1, 1L (lab)** and **2, 2L (lab)**.

UPPER DIVISION

The following upper-division courses are required for the two majors in chemistry: **Chemistry 104, 106, 114, 115, 130**. Each major concentration has additional upper-division requirements as follows:

- For the standard chemistry major, students must take **Chemistry 110, 113, 111** or **119, 118, 197** or **199**.
- For the environmental concentration, students must take **Chemistry 113** or **118, 119**, and one other upper-division chemistry course. Also required are **Biology 125** and either **Biology 113, 146**, or **152**.

MINOR REQUIREMENTS

The minor in chemistry requires **Chemistry 8, 9 (lab)** and **10, 11 (lab)**, and any three upper-division chemistry courses beyond **Chemistry 104**.

PREREQUISITE GRADE

Any course listed in this department with a prerequisite assumes a grade of C– or better in the prerequisite course, unless noted otherwise in the course description.

C O U R S E S**LOWER DIVISION****2 Principles of Chemistry**

An introduction to topics in general chemistry, organic chemistry, and biochemistry for those students with an interest in the life sciences. This course is designed primarily for kinesiology students. Others may enroll in this course if they have been sufficiently counseled as to whether it is appropriate to their needs. Four lectures per week. *Prerequisite: one year of high school chemistry. Offered every spring.*

3 Principles of Chemistry Lab (.25)

Laboratory to accompany **Chemistry 2**. Must be taken concurrently with **Chemistry 2**. *Laboratory fee required. Offered every spring.*

8 General Chemistry I

A study of the fundamental principles of chemical science and the chemistry of the more common elements and their compounds. Four lectures per week. Admission requires high school chemistry and placement in **Math 13, 27**, or equivalent. *Offered every semester. This course satisfies the Scientific Understanding requirement of the Core Curriculum.*

9 General Chemistry Lab I (.25)

Laboratory to accompany **Chemistry 8**. Must be taken concurrently with **Chemistry 8**. An introduction to experimentation in chemistry. One lab per week. *Laboratory fee required. Offered every semester.*

10 General Chemistry II

A continuation of **Chemistry 8**. Four lectures per week. *Prerequisites: Chemistry 8, 9 with grades of C– or better. Offered every spring.*

11 General Chemistry Lab II (.25)

Laboratory to accompany **Chemistry 10**. Must be taken concurrently with **Chemistry 10**. One lab per week. *Prerequisites: Chemistry 8, 9. Laboratory fee required. Offered every spring.*

89 Chemical Literature (.25)

A systematic survey of the literature of chemistry and allied fields. Practice in the retrieval, evaluation, and use of chemical information. *This course, taken with Chemistry 110, satisfies the Writing in the Disciplines requirement of the Core Curriculum. Offered every fall.*

UPPER DIVISION

Chemistry 8, 9 (lab), 10 and **11 (lab)** with grades of C– or better are prerequisite to all upper-division courses. **Chemistry 104** and **106** are prerequisite to **Chemistry 110, 111** and **130, 135, 136** and **138**.

104 Organic Chemistry I

An introduction to the concepts of structure and reactivity of organic compounds. Four lectures and one lab per week. *Laboratory fee required. Offered every fall.*

106 Organic Chemistry II

A continuation of **Chemistry 104**. Four lectures and one lab per week. *Prerequisite: Chemistry 104 with a grade of C– or better. Laboratory fee required. Offered every spring.*

110 Special Topics in Chemistry

An exploration of important areas in modern chemical research involving various elements of the discipline. The course includes reading and discussion of journal articles and may include use of the computer for molecular modeling, information retrieval and analysis of data, depending on the selected topics. A prime learning objective of this course is to assist the student to use other instructional materials besides textbooks. *Prerequisites: Chemistry 89 and Chemistry 130. Offered in alternate years, spring semester. This course, taken with Chemistry 89, satisfies the Writing in the Disciplines requirement of the Core Curriculum.*

111 Advanced Organic Chemistry

An in-depth examination of the mechanisms of organic reactions, the methods used to study them, and the relationship between structure and reactivity. Selected advanced synthetic methods may also be covered. Three lectures per week. *Offered in alternate years, spring semester.*

113 Analytical Chemistry

Study of the fundamentals of analytical chemistry with emphasis on careful experimental technique. Topics will include a deeper understanding of equilibrium systems and statistical data analysis. Laboratory (**113L**) includes volumetric, electro-analytical, and spectroscopic methods. Two lectures and two labs per week. *Prerequisites: Chemistry 10/11. Laboratory fee required. Offered every year, fall semester.*

114 Physical Chemistry I

A study of chemical theory, specifically thermodynamics, chemical kinetics, and quantum mechanics. Three lectures and one lab per week. *Prerequisites: Mathematics 27, 28 (38 preferred). Laboratory fee required. Offered in alternate years, fall semester.*

115 Physical Chemistry II

A continuation of **Chemistry 114**. Three lectures and one lab per week. *Prerequisite: Chemistry 114 with a passing grade. Laboratory fee required. Offered in alternate years, spring semester.*

Curriculum Chemistry

118 Instrumental Chemical Analysis

A study of the principles used in the design and operation of instruments and their applications in chemistry. Two lectures and two labs per week. *Laboratory fee required. Offered in alternate years, spring semester.*

119 Environmental Chemistry

A study of the theory and practice of water, air and soil chemistry with emphasis on the problem areas within our environment. Three lectures and one lab per week. *Laboratory fee required. This course satisfies the Community Engagement requirement of the Core Curriculum. Offered in alternate years, fall semester.*

130 Advanced Inorganic Chemistry

A study of the structures, reactions and relationships of the elements and their compounds. Three lectures per week. *Offered in alternate years, fall semester.*

135 Biochemistry (cross-listed with **Biology**)

A study of biochemical principles with an emphasis on enzymes and metabolism of biochemistry. Three lectures and one lab per week. *Laboratory fee required. Offered every semester. Prerequisites: **Biology 1, 1L.***

136 Advanced Topics in Biochemistry

(cross-listed with **Biology**)

A further study of biochemical principles with an emphasis on macromolecular structures, membrane related topics (structure, transport, signal recognition and transduction), and other topics not covered in the first semester of biochemistry. Three lectures and one lab per week. *Laboratory fee required. Offered every year, spring semester. Prerequisite: **Biochemistry 135 (Bio 135).***

138 Biophysical Chemistry

A study of the physical chemical aspects of biochemistry. Three lectures per week. *Offered in alternate years, spring semester. Prerequisites: **Mathematics 27, and 28, or 38.***

197 Special Study

Laboratory research in chemistry, under the direction of a faculty advisor. Results from the research project will be summarized in the form of a written thesis and an oral or poster presentation. *Prerequisites: senior standing and the consent of the faculty advisor. Laboratory fee required. Offered as needed.*

199 Special Study – Honors

Laboratory research in chemistry, under the direction of a faculty advisor. Results from the research project will be summarized in the form of a written thesis and an oral or poster presentation. *Prerequisites: senior standing, a 3.0 GPA (minimum) in chemistry coursework and the consent of the faculty advisor. Laboratory fee required. Offered as needed.*