

# Chemistry

## Department Faculty

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## Department Goals

### For General Education

To present, through the general survey course, both information about and insight into the manner in which the creation is sustained by God and thereby to increase students' appreciation of God's glory in what He has made and to help equip students to be better stewards of creation.

### For the Major Field

To provide students with a large body of information and techniques and with an appreciation of the role of chemical investigation in the Kingdom of God. To prepare students for careers in professional chemistry or for admission into medical school.

### For Related Fields

To meet the needs of students with career interests in other natural sciences and the health care professions. To provide some measure of technical expertise and grasp of the limitations and successful applications of chemistry as it relates to other callings.

## Requirements for Major in Chemistry

The core and distribution requirements for a major in chemistry are those listed for baccalaureate degrees on page 24 with the exception that mathematics (3 hours) and that PHY231. General Physics is fulfilling the natural science lab requirement, and is already required for the major.

Entering freshmen who plan to major in chemistry should plan to take MAT 145. Calculus I the first year. Placement in Calculus is based on a strong high school math background (through trigonometry) which is evidenced by an SAT math score of 600 or ACT math of 25. Students who do not place into Calculus should sit for the Math Placement Exam during Orientation.

The chemistry major calls for early and extensive counseling of students in order that they be properly informed of the requirements and aims of the program. Students entering this program will ordinarily have to make

their decisions earlier in their college career than is necessary for some other programs.

The department assesses its program in part through the administration of nationally-standardized examinations as final examinations in each of its courses or course sequences. Students who complete chemistry courses at other institutions should have their scores on the appropriate Examinations Institute of the American Chemical Society test transmitted to the Chemistry Department. Otherwise the examination must be taken at Covenant. A score of 90 percentile or above is expected if a transferred course is to satisfy a program requirement which specifies a particular chemistry course.

Core requirements .....	51
Electives .....	13

## Chemistry Major and Supporting Course Requirements

### General Professional Option

CHE 121-122. General Chemistry I, II.....	8
CHE 225. Analytical Chemistry .....	4
CHE 323-324. Organic Chemistry I, II .....	8
CHE 326. Instrumental Analysis .....	4
CHE 425-426. Physical Chemistry I, II.....	8
CHE 491. Meta-chemistry and the SIP 'S' .....	2
CHE 492. Senior Integration Paper .....	2
Chemistry electives - If a minor is desired, electives may be reduced to 3 hours. ....	6
MAT 145-146. Calculus I, II.....	8
MAT 247. Calculus III .....	4
PHY 231-232. General Physics 'W' .....	8
Total hours for the major .....	<u>62</u>
Total degree hours.....	126

## Georgia Secondary School Certification

Certification to teach chemistry at the secondary level can be pursued by selecting a concentration in chemistry within the major in natural science. See the requirements for the Broad Fields Science Certification in the Natural Science section on page 112.

## Requirements for Minor in Chemistry

CHE 121-122. General Chemistry I, II.....	8
Chemistry electives (CHE 225 or above) .....	<u>12</u>
Total hours for the minor .....	20

At least 12 of these 20 hours must be completed at Covenant.

## Chemistry Courses

### 103. Introductory Chemistry I

An introduction to the science of chemistry with emphasis on basic atomic theory, chemical reactions, properties of the various physical states, and some descriptive chemistry. This course is designed for pre-nursing students and for those electing to take chemistry to fulfill the core natural science lab distribution requirement. Other students needing to take chemistry should enroll in CHE 121 unless they do not have the prerequisites for that course. Students may not receive credit for both CHE 103 and CHE 121. Three hours lecture. Three hours laboratory. Laboratory fee: \$17. Four hours. LAB

### 104. Introductory Chemistry II

Basic organic chemistry and an introduction to biochemistry. Common functional groups and classes of compounds important in human biochemistry are studied. Emphasis on chemistry related to nursing science. Students may not receive credit for both CHE 104 and CHE 122. Prerequisite: CHE 103 or permission of the instructor. Three hours lecture. Three hours laboratory. Laboratory fee: \$17. Four hours.

### 121. General Chemistry I

Fundamental chemical principles and their applications. Atomic theory, stoichiometry, molecular structure, and the properties of the various physical states are presented. This course is designed for students in the following programs: chemistry major, biology major, pre-medical program, and pre-engineering program. Students may not receive credit for both CHE 103 and CHE 121. Prerequisites: one year of high school chemistry, and MAT 141 or math placement level 3 or higher, or permission of the instructor. High school physics strongly recommended. Co-requisite: CHE 121L. Three hours.

### 121L. General Chemistry I Laboratory

The laboratory component of the General Chemistry I course. Normally co-requisite with CHE 121; see Department Chair for exceptions. Three hours laboratory. Laboratory fee: \$17. One hour.

### 122. General Chemistry II

A continuation of CHE 121. Solution properties and additional aspects of chemical bonding and structure are presented. Chemical kinetics, equilibrium, electrochemistry, and some descriptive chemistry are studied. Students may not receive credit for both CHE 104 and CHE 122. Co-requisite: CHE122L. Prerequisite: CHE 121. Three hours.

### 122L. General Chemistry II Laboratory

The laboratory component of the General Chemistry II course. Qualitative analysis is included as a major component of this laboratory. Normally co-requisite with

CHE 122; see Department Chair for exceptions. Three hours laboratory. Laboratory fee: \$17. One hour.

### 225. Analytical Chemistry

An introduction to the principles and practices of quantitative chemical analysis. Gravimetric, volumetric, and potentiometric methods are studied. Includes statistical evaluation of data and experimental design. Prerequisites: CHE 121, 122. Two hours lecture. Six hours laboratory. Laboratory fee: \$20. Four hours.

### 323. Organic Chemistry I

A study of the chemistry of hydrocarbons, alkyl halides, alcohols, and ethers. Molecular structure, stereochemistry, methods of preparation, physical properties, and reactions are covered. Infrared and nuclear magnetic resonance spectroscopy are introduced. Reaction mechanisms are stressed. Prerequisite: CHE 122 or a grade of "B" or better in CHE 104. Three hours lecture. Four hours laboratory. Laboratory fee: \$20. Four hours.

### 324. Organic Chemistry II

A continuation of the study of organic compounds. Families covered include aromatic hydrocarbons, phenols, aryl halides, aldehydes, ketones, carboxylic acids and their derivatives, amines, carbohydrates, lipids, amino acids, proteins, and nucleic acids. Prerequisite: CHE 323. Three hours lecture. Four hours laboratory. Laboratory fee \$20. Four hours.

### 326. Instrumental Analysis

Principles of design and operation of modern instrumentation in chemistry. Consideration of methods common in chemical research as well as in applied sciences such as environmental monitoring and medicine. Techniques include: optical spectroscopies, magnetic resonance, mass spectrometry, instrumental chromatographies, and dynamic electrochemistry, introduction to digital signal processing and laboratory automation. Prerequisites: CHE 225; PHY 231, 232. Three hours lecture. Four hours laboratory. Laboratory fee: \$20. Four hours.

### 332. Environmental Chemistry

Principles and analysis of chemical movement and distribution in natural environments. Sampling and analytical methods are included for water, soil, and air. Work will be conducted both on site in natural habitats and in the laboratory. Prerequisite: one year of general chemistry and one semester of either biochemistry or organic chemistry. AuSable Institute. Four hours.

### 401-402. Research

One or two semesters of chemical research may be carried out by qualified students. Includes the study of the use of chemical literature, followed by application to a specific

chemical research project. Both CHE 401 and CHE 402 may be taken more than once, but cannot be counted as chemistry electives for the major or the minor. Prerequisite: CHE 324. One to two hours per semester.

#### **422. Advanced Organic Chemistry**

An intensive study of selected topics in organic chemistry. Laboratory work consists of purification and systematic identification of organic compounds. Prerequisite: CHE 324. Three hours lecture. Four hours laboratory. Laboratory fee: \$20. Four hours.

#### **423. Biochemistry**

A study of the chemistry of nucleic acids, proteins, carbohydrates, lipids, and enzymes. Also included is a study of catabolism with a focus on glycolysis, gluconeogenesis, glycogen metabolism, the citric acid cycle, and electron transport. Prerequisite: CHE 324. Three hours lecture. Four hours laboratory. Laboratory fee: \$20. Four hours.

#### **425. Physical Chemistry I**

A study of the gaseous, liquid, and solid states of matter using classical and statistical thermodynamics. Prerequisites: CHE 121, 122; PHY 231, 232; MAT 145, 146. PHY 232 may be co-requisite if necessary. Three hours lecture. Three hours laboratory. Laboratory fee: \$20. Four hours.

#### **426. Physical Chemistry II**

A study of quantum mechanics, chemical equilibria, electrochemistry, and chemical kinetics. Prerequisite: CHE 425. Three hours lecture. Three hours laboratory. Laboratory fee: \$20. Four hours.

#### **428. Inorganic Chemistry**

An advanced study of the theory and practice of modern inorganic chemistry. Includes the synthesis and reactions of inorganic compounds, reaction mechanisms, crystal theory, and group theory. The laboratory (optional) stresses advanced techniques in synthetic inorganic chemistry. Prerequisites: CHE 121, 122. Three hours lecture. Three hours laboratory (optional). Laboratory fee. Three or four hours.

#### **491. Meta-chemistry and the Senior Integration Paper**

Designed to help senior chemistry majors develop the perspective on their discipline and the analytical skills necessary to produce a Senior Integration Paper which will explicitly exhibit the character of a Christian heart and mind functioning in a "worldview-ish" mode. Students will become familiar with the historical, philosophical and theological context of modern science in general and modern chemistry in particular. By the end of the course students will have chosen a topic of interest suitable for their Senior Integration Paper. Two hours lecture. Two hours. 'S'

#### **492. Senior Integration Paper in Chemistry**

See page 26. Prerequisite: CHE 491 or PHY 491 or BIO 491 or PHI 283. Two hours.