

# Chemistry

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The Department of Chemistry is one of the oldest departments in the university and has a long record of preparing students for careers in science. Both Bachelor of Arts (B.A.) and Bachelor of Science (B.S.) degrees are available, depending upon a student's career goals. Since a significant portion of America's chemical industry is centered in the Philadelphia region, there is a wide range of career opportunities locally available. Although most of our students have gone on to medicine, dentistry, or the chemical industry, recent graduates have also gone on to careers in law, forensics, and even art restoration.

All prospective majors should schedule an appointment with one of the departmental advisors (see list below) to plan a program of study.

The Bachelor of Arts in Chemistry is designed for students who are planning for a non-research career in a field related to Chemistry. Students learn a wide array of topics in Chemistry, Mathematics, and Physics. Students learn how to write scientific reports, analyze data, and place these results in a broader scientific context.

The Bachelor of Science in Chemistry prepares students for excellence in graduate or medical school, and employment in the chemical, biotechnological, or pharmaceutical industries. Students learn a wide array of topics in Chemistry, Mathematics, and Physics. The program emphasizes the "hands-on" nature of chemistry in laboratory courses, giving students the tools that chemists need to pursue research. They also learn how to write scientific reports, analyze data, and place these results in a broader scientific context. Accomplished majors are encouraged to pursue independent research with a professor, and to present their work internally and at national meetings.

The Bachelor of Science in Biochemistry prepares students for excellence in graduate or medical school, and employment in the chemical, biotechnological, or pharmaceutical industries. Students learn a wide array of topics in Biology, Chemistry, Mathematics, and Physics. In upper division studies, Biochemistry majors learn to apply biochemical principles to real-life situations via problem-based approaches in their courses. Laboratory courses give students the tools they will need as biochemists to pursue research. Accomplished majors are encouraged to pursue independent research with a professor, and to present their work internally and at national meetings.

## Undergraduate Contact Information:

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Note: Due to restricted access to the 6th floor of SERC, please email Dr. Zdilla to set up an appointment.

## Programs

- Biochemistry, B.S. (<http://bulletin.temple.edu/undergraduate/science-technology/chemistry/biochemistry-bs>)
- Chemistry with Teaching, B.S. (<http://bulletin.temple.edu/undergraduate/science-technology/tu-teach-programs/tu-teach-chemistry-bs/#chemistry>)
- Chemistry, B.A. (<http://bulletin.temple.edu/undergraduate/science-technology/chemistry/chemistry-ba>)
- Chemistry, B.A./M.Ed. (<http://bulletin.temple.edu/undergraduate/science-technology/accelerated-programs/chemistry-ba-med/#chemistry>)
- Chemistry, B.A./M.S. (<http://bulletin.temple.edu/undergraduate/science-technology/accelerated-programs/chemistry-ba-ms/#chemistry>)
- Chemistry, B.S. (<http://bulletin.temple.edu/undergraduate/science-technology/chemistry/chemistry-bs>)
- Chemistry, B.S./M.Ed. (<http://bulletin.temple.edu/undergraduate/science-technology/accelerated-programs/chemistry-bs-med/#chemistry>)
- Chemistry, B.S./M.S. (<http://bulletin.temple.edu/undergraduate/science-technology/accelerated-programs/chemistry-bs-ms/#chemistry>)
- Chemistry, Minor (<http://bulletin.temple.edu/undergraduate/science-technology/chemistry/chemistry-minor>)
- General Science with Teaching, B.S. (<http://bulletin.temple.edu/undergraduate/science-technology/tu-teach-programs/tu-teach-general-science-bs/#chemistry>)
- Natural Sciences, B.A. (<http://bulletin.temple.edu/undergraduate/science-technology/biology/natural-sciences-ba/#chemistry>)
- Natural Sciences, B.S. (<http://bulletin.temple.edu/undergraduate/science-technology/biology/natural-sciences-bs/#chemistry>)

## Courses

### **CHEM 0821. Chemistry of Wine. 3 Credit Hours.**

This course is typically offered in Fall.

Wine has occupied a central role in human culture. In our exploration of the science of wine we will learn why wine was the beverage of choice through the ages, why a bottle of wine can range from \$2 to \$2,000, how wine is made, what makes a good/bad wine, how is white different from red, and how we know what is in a bottle of wine. The course begins with a large scale fermentation of red and white wine and will continue with team-based analyses of the two month process of turning grape juice into wine. Many aspects of the production and consumption of wine will be addressed in this course.

NOTE: This course fulfills a Science & Technology (GS) requirement for students under GenEd and the Science & Technology Second Level (SB) requirement for students under Core.

**Course Attributes:** GS

**Repeatability:** This course may not be repeated for additional credits.

### **CHEM 0838. Nature Has No Reverse. 3 Credit Hours.**

This course is not offered every year.

Rapid advances in modern science often tend to conceal the "forest in the trees," but we all need enough familiarity with the "scientific method" to make informed judgments as citizens and voters. This course will take you on a journey through the history of science, with stops at the Second Law of Thermodynamics, the "revolution" of fire, the rational basis of life, energy as the universal currency and changes in the universe around us. We will end with that most disturbing of paradoxes: the certainty of uncertainty. Each week includes both lecture and hands-on demonstration/practicum. NOTE: This course fulfills a Science & Technology (GS) requirement for students under GenEd and the Science & Technology Second Level (SB) requirement for students under Core.

**Course Attributes:** GS

**Repeatability:** This course may not be repeated for additional credits.

**CHEM 1005. Practice and Development of Spatial Visualization Skills. 1 Credit Hour.**

The ability to mentally visualize in three dimensions is an important skill for scientists. In this course, students will move through ten different modules that will strengthen spatial reasoning and visualization skills. All assigned work will be completed during the scheduled class time. This course is restricted to students taking CHEM 1031, 1035, or 1951, and who have scored <70% on the PSVT:R.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

CHEM 1031|Minimum Grade of C-|May be taken concurrently  
OR CHEM 1035|Minimum Grade of C-|May be taken concurrently  
OR CHEM 1951|Minimum Grade of C-|May be taken concurrently.

**CHEM 1011. Chemistry: The Study of Matter I. 4 Credit Hours.**

This course is typically offered in Fall and Spring.

Four hours of lecture and demonstration per week; intended to be the primary course for those who take chemistry only to satisfy their Core requirements. Important chemical phenomena and their explanations. Special emphasis on the use of chemical theories and development of mathematical skills needed for their use. NOTE: (1) Because fundamental science is presented, this sequence is also recommended for students who would like to enter a scientific field but fear their background is not adequate. (2) This course can be used to satisfy the university Core Science & Technology First Level (SA) requirement.

**Course Attributes:** SA

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

MATH 0701 to 0702| Required Courses:1|Minimum Grade of C-|May not be taken concurrently  
OR MATH 0800 to 4999| Required Courses:1|Minimum Grade of C-|May be taken concurrently  
OR MC3 Y|May not be taken concurrently  
OR MC4 Y|May not be taken concurrently  
OR MC5 Y|May not be taken concurrently  
OR MC6 Y|May not be taken concurrently  
OR STAT 1001|Minimum Grade of C-|May be taken concurrently  
OR STT2 Y|May not be taken concurrently  
OR STAT 1102|Minimum Grade of C-|May be taken concurrently  
OR STAT 1902|Minimum Grade of C-|May be taken concurrently  
OR MC3A Y|May not be taken concurrently  
OR MC6A Y|May not be taken concurrently.

**CHEM 1021. Introduction to Chemistry I. 3 Credit Hours.**

This course is typically offered in Fall and Summer I.

The first semester of a course designed for the non-science major, introducing chemical principles in the context of everyday life. Fundamental concepts of chemistry including atomic theory, the mole concept, acids and bases, and physical properties of substances. NOTE: (1) Appropriate for some Allied Health students; check the requirements of your program. (2) This course can be used to satisfy the university Core Science & Technology First Level (SA) requirement. To determine if this course in combination with another course can satisfy the GenEd Science & Technology requirement, see your advisor.

**Course Attributes:** SA

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

MATH 0701 to 0702| Required Courses:1|Minimum Grade of C|May not be taken concurrently  
OR MATH 1021 to 4999| Required Courses:1|Minimum Grade of C-|May be taken concurrently  
OR MC3 Y|May not be taken concurrently  
OR MC4 Y|May not be taken concurrently  
OR MC5 Y|May not be taken concurrently  
OR MC6 Y|May not be taken concurrently  
OR MA01 Y|May not be taken concurrently  
OR STAT 1001|Minimum Grade of C-|May be taken concurrently  
OR STT2 Y|May not be taken concurrently  
OR STAT 1102|Minimum Grade of C-|May be taken concurrently  
OR STAT 1902|Minimum Grade of C-|May be taken concurrently  
OR MC3A Y|May not be taken concurrently  
OR MC6A Y|May not be taken concurrently.

**CHEM 1022. Introduction to Chemistry II. 3 Credit Hours.**

This course is typically offered in Spring and Summer II.

An introduction to organic and biochemistry. Emphasis on relationships between carbon compounds and the chemistry of living systems, the interaction of chemical science with current technology, and chemicals in the environment. NOTE: This course can be used to satisfy the university Core Science & Technology Second Level (SB) requirement. To determine if this course in combination with another course can satisfy the GenEd Science & Technology requirement, see your advisor.

**Course Attributes:** SB

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

CHEM 1021|Minimum Grade of C-|May not be taken concurrently.

**CHEM 1023. Introduction to Chemistry Laboratory I. 1 Credit Hour.**

This course is typically offered in Fall and Summer I.

Introduction to experimental inorganic chemistry and general chemical techniques. NOTE: This course can be used to satisfy the university Core Science & Technology First Level (SA) requirement. To determine if this course in combination with another course can satisfy the GenEd Science & Technology requirement, see your advisor.

**Course Attributes:** SA

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(MATH 0701 to 0702| Required Courses:1|Minimum Grade of C|May not be taken concurrently

OR MATH 1021 to 4999| Required Courses:1|Minimum Grade of C-|May be taken concurrently

OR MC3 Y|May not be taken concurrently

OR MC4 Y|May not be taken concurrently

OR MC5 Y|May not be taken concurrently

OR MC6 Y|May not be taken concurrently

OR MA01 Y|May not be taken concurrently

OR STAT 1001|Minimum Grade of C-|May be taken concurrently

OR STT2 Y|May not be taken concurrently

OR STAT 1102|Minimum Grade of C-|May be taken concurrently

OR STAT 1902|Minimum Grade of C-|May be taken concurrently

OR MC3A Y|May not be taken concurrently

OR MC6A Y|May not be taken concurrently)

AND (CHEM 1021|Minimum Grade of C-|May be taken concurrently)

**CHEM 1024. Introduction to Chemistry Laboratory II. 1 Credit Hour.**

This course is typically offered in Spring and Summer II.

Introduction to experimental organic and biological chemistry. NOTE: This course can be used to satisfy the university Core Science & Technology Second Level (SB) requirement. To determine if this course in combination with another course can satisfy the GenEd Science & Technology requirement, see your advisor.

**Course Attributes:** SB

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 1023|Minimum Grade of C-|May not be taken concurrently)

AND (CHEM 1022|Minimum Grade of C-|May be taken concurrently)

**CHEM 1027. Applications of Chemistry. 4 Credit Hours.**

This course is typically offered in Fall, Spring, and Summer II.

This course is a transition semester of chemistry to be taken before Chemistry 1031 (C071) designed for students who have not had enough preparation in chemistry or mathematics to directly take Chemistry 1031 (C071). Mathematical concepts and chemical principles will be integrated into a series of common applications. In this class, students will learn proper handling of laboratory materials and perform experiments that are integrated with, as well as introduce and reinforce, the material from the lecture. This course is intended to prepare students for General Chemistry by emphasizing the mathematical basis of chemistry and laboratory measurements. A quantitative introduction to atomic and molecular structure, states of matter, basic thermodynamics, solutions, gas laws, kinetics, and equilibrium. NOTE: Students must register for 2 sections: one of which is a combination of lecture and lab for 4 credits and the other is a 0 credit recitation.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

MATH 1021|Minimum Grade of C|May be taken concurrently

OR MATH 1022 to 4999| Required Courses:1|Minimum Grade of C-|May be taken concurrently

OR MC5 Y|May not be taken concurrently

OR MC6 Y|May not be taken concurrently

OR STAT 1001|Minimum Grade of C|May not be taken concurrently

OR STAT 1102|Minimum Grade of C|May not be taken concurrently

OR STAT 1902|Minimum Grade of C|May not be taken concurrently

OR MC6A Y|May not be taken concurrently.

**CHEM 1031. General Chemistry I. 3 Credit Hours.**

This course is typically offered in Fall, Spring, and Summer I.

The first semester of chemistry for science majors, pre-professional students, and others in science related fields. A quantitative introduction to atomic and molecular structure, states of matter, basic thermodynamics, and solutions. NOTE: This course can be used to satisfy the university Core Science & Technology First Level (SA) requirement. To determine if this course in combination with another course can satisfy the GenEd Science & Technology requirement, see your advisor.

**Course Attributes:** SA

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

MATH 1021|Minimum Grade of C|May not be taken concurrently

OR MATH 1022 to 4999| Required Courses:1|Minimum Grade of C-|May be taken concurrently

OR MC5 Y|May not be taken concurrently

OR MC6 Y|May not be taken concurrently

OR MA03 Y|May not be taken concurrently

OR STAT 1001|Minimum Grade of C|May not be taken concurrently

OR STAT 1102|Minimum Grade of C|May not be taken concurrently

OR MC6A Y|May not be taken concurrently.

**CHEM 1032. General Chemistry II. 3 Credit Hours.**

This course is typically offered in Fall, Spring, Summer I and Summer II.

The second semester of chemistry for science majors, pre-professional students, and others in science related fields. An introduction to thermodynamics, equilibrium, kinetics, electrochemistry, and descriptive chemistry. NOTE: This course can be used to satisfy the university Core Science & Technology Second Level (SB) requirement. To determine if this course in combination with another course can satisfy the GenEd Science & Technology requirement, see your advisor.

**Course Attributes:** SB

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

CHEM 1031|Minimum Grade of C-|May not be taken concurrently

OR CHEM 1041|Minimum Grade of C-|May not be taken concurrently

OR CHEM 1951|Minimum Grade of C-|May not be taken concurrently.

**CHEM 1033. General Chemistry Laboratory I. 1 Credit Hour.**

This course is typically offered in Fall, Spring, and Summer I.

An introduction to experimental chemistry, including the determination of molecular weights, calorimetry, and fundamental analytical techniques. NOTE: This course can be used to satisfy the university Core Science & Technology First Level (SA) requirement. To determine if this course in combination with another course can satisfy the GenEd Science & Technology requirement, see your advisor.

**Course Attributes:** SA

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(MATH 1021|Minimum Grade of C|May not be taken concurrently

OR MATH 1022 to 4999| Required Courses:1|Minimum Grade of C-|May be taken concurrently

OR MC5 Y|May not be taken concurrently

OR MC6 Y|May not be taken concurrently

OR MA03 Y|May not be taken concurrently

OR STAT 1001|Minimum Grade of C|May not be taken concurrently

OR STAT 1102|Minimum Grade of C|May not be taken concurrently

OR MC6A Y|May not be taken concurrently)

AND (CHEM 1031|Minimum Grade of C-|May be taken concurrently

OR CHEM 1035|Minimum Grade of C-|May be taken concurrently

OR CHEM 1041|Minimum Grade of C-|May be taken concurrently

OR CHEM 1951|Minimum Grade of C-|May be taken concurrently)

**CHEM 1034. General Chemistry Laboratory II. 1 Credit Hour.**

This course is typically offered in Fall, Spring, Summer I and Summer II.

Experiments in equilibrium, kinetics, acid-base and oxidation reduction titrations, electrochemistry, and synthesis of metal complexes. NOTE: This course can be used to satisfy the university Core Science & Technology Second Level (SB) requirement. To determine if this course in combination with another course can satisfy the GenEd Science & Technology requirement, see your advisor.

**Course Attributes:** SB

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 1033|Minimum Grade of C-|May not be taken concurrently

OR CHEM 1043|Minimum Grade of C-|May not be taken concurrently

OR CHEM 1953|Minimum Grade of C-|May not be taken concurrently)

AND (CHEM 1032|Minimum Grade of C-|May be taken concurrently

OR CHEM 1042|Minimum Grade of C-|May be taken concurrently

OR CHEM 1952|Minimum Grade of C-|May be taken concurrently)

**CHEM 1035. Chemistry for Engineers. 3 Credit Hours.**

This course is typically offered in Fall and Spring.

The course is specifically designed to provide Engineering students with a concise, but comprehensive treatment of chemical principles. An objective of the course is to present concepts in an engineering context. This will be accomplished in part by discussing how chemical principles provide a foundation for engineering and technology. Topics to be included will be states of matter, reaction stoichiometry, atomic and molecular structure, chemical equilibria, thermodynamics, and kinetics. The course will consist of three hours of lecture and one hour of recitation per week. CHEM 1033 is normally taken concurrently.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

MATH 1022|Minimum Grade of C|May not be taken concurrently

OR MATH 1038 to 4999| Required Courses:1|Minimum Grade of C-|May be taken concurrently

OR MC6 Y|May not be taken concurrently

OR MA04 Y|May not be taken concurrently

OR MC6A Y|May not be taken concurrently.

**CHEM 1051. Basic Core General Chemistry I. 3 Credit Hours.**

This is the first semester of general chemistry for post-baccalaureate students. It includes a quantitative introduction to atomic and molecular structure, states of matter, basic thermodynamics, and solutions. These topics will be covered with special consideration of their relevance to the health sciences.

**Repeatability:** This course may not be repeated for additional credits.

**CHEM 1052. Basic Core General Chemistry II. 3 Credit Hours.**

This is the second semester of general chemistry for post-baccalaureate students. It includes an introduction to thermodynamics, equilibrium, kinetics, electrochemistry, and descriptive chemistry. These topics will be covered with special consideration of their relevance to the health sciences.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

CHEM 1051|Minimum Grade of C-|May not be taken concurrently.

**CHEM 1053. Basic Core General Chemistry Lab I. 1 Credit Hour.**

This course is typically offered in Summer I.

This is the laboratory to accompany the first semester of general chemistry for post-baccalaureate students. It includes a quantitative introduction to atomic and molecular structure, states of matter, basic thermodynamics, and solutions. These topics will be covered with special consideration of their relevance to the health sciences.

**Repeatability:** This course may not be repeated for additional credits.

**CHEM 1054. Basic Core General Chemistry Lab II. 1 Credit Hour.**

This course is typically offered in Summer II.

This is the laboratory to accompany the second semester of general chemistry for post-baccalaureate students. It includes hands-on investigations of an introduction to thermodynamics, equilibrium, kinetics, electrochemistry, and descriptive chemistry. These topics will be covered with special consideration of their relevance to the health sciences.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 1052)|Minimum Grade of C-|May be taken concurrently)

AND (CHEM 1053)|Minimum Grade of C-|May not be taken concurrently)

**CHEM 1951. Honors General Chemical Science I. 3 Credit Hours.**

This course is typically offered in Fall.

When taken with Chemistry 1953 (H093), this course meets pre-professional requirements. Similar to Chemistry 1031 (C071) but with added emphasis on topics of current interest to the professional chemist. NOTE: This course can be used to satisfy the university Core Science & Technology First Level (SA) requirement. To determine if this course in combination with another course can satisfy the GenEd Science & Technology requirement, see your advisor.

**Cohort Restrictions:** Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR.

**Course Attributes:** HO, SA

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

MATH 1041|Minimum Grade of C|May be taken concurrently

OR MATH 1941|Minimum Grade of C|May be taken concurrently

OR MATH 1038|Minimum Grade of C|May be taken concurrently

OR MATH 1042|Minimum Grade of C-|May be taken concurrently

OR MATH 1044|Minimum Grade of C-|May be taken concurrently

OR MATH 1942|Minimum Grade of C-|May be taken concurrently

OR MATH 1951|Minimum Grade of C-|May be taken concurrently

OR MATH 2043 to 3080| Required Courses:1|Minimum Grade of D|May be taken concurrently

OR MA06 Y|May not be taken concurrently.

**CHEM 1952. Honors General Chemical Science II. 3 Credit Hours.**

This course is typically offered in Spring.

Similar to Chemistry 1032 (C072), but with added emphasis on topics of current interest to the professional chemist. NOTE: This course can be used to satisfy the university Core Science & Technology Second Level (SB) requirement. To determine if this course in combination with another course can satisfy the GenEd Science & Technology requirement, see your advisor.

**Cohort Restrictions:** Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR.

**Course Attributes:** HO, SB

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 1951|Minimum Grade of C-|May not be taken concurrently)  
AND (MATH 1042|Minimum Grade of C-|May be taken concurrently  
OR MATH 1044|Minimum Grade of C-|May be taken concurrently  
OR MATH 1942|Minimum Grade of C-|May be taken concurrently  
OR MATH 1951|Minimum Grade of C-|May not be taken concurrently  
OR MATH 2043 to 3080| Required Courses:1|Minimum Grade of C-|May be taken concurrently  
OR MA07 Y|May not be taken concurrently)

**CHEM 1953. Honors Chemical Science Laboratory I. 1 Credit Hour.**

This course is typically offered in Fall.

An introduction to the experimental techniques employed in the determination of the physical and chemical properties of matter. NOTE: This course can be used to satisfy the university Core Science & Technology First Level (SA) requirement. To determine if this course in combination with another course can satisfy the GenEd Science & Technology requirement, see your advisor.

**Cohort Restrictions:** Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR.

**Course Attributes:** HO, SA

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(MATH 1041|Minimum Grade of C|May be taken concurrently  
OR MATH 1941|Minimum Grade of C|May be taken concurrently  
OR MATH 1038|Minimum Grade of C|May be taken concurrently  
OR MATH 1042|Minimum Grade of C-|May be taken concurrently  
OR MATH 1044|Minimum Grade of C-|May be taken concurrently  
OR MATH 1942|Minimum Grade of C-|May be taken concurrently  
OR MATH 1951|Minimum Grade of C-|May be taken concurrently  
OR MATH 2043 to 3080| Required Courses:1|Minimum Grade of D|May be taken concurrently  
OR MA06 Y|May not be taken concurrently)  
AND (CHEM 1031|Minimum Grade of C-|May be taken concurrently  
OR CHEM 1041|Minimum Grade of C-|May be taken concurrently  
OR CHEM 1951|Minimum Grade of C-|May be taken concurrently)

**CHEM 1954. Honors Chemical Science Laboratory II. 1 Credit Hour.**

This course is typically offered in Spring.

Introduction to the experimental techniques employed in the determination of the physical and chemical properties of matter. NOTE: This course can be used to satisfy the university Core Science & Technology Second Level (SB) requirement. To determine if this course in combination with another course can satisfy the GenEd Science & Technology requirement, see your advisor.

**Cohort Restrictions:** Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR.

**Course Attributes:** HO, SB

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 1951|Minimum Grade of C-|May not be taken concurrently)  
AND (CHEM 1953|Minimum Grade of C-|May not be taken concurrently)  
AND (CHEM 1952|Minimum Grade of C-|May be taken concurrently)

**CHEM 2201. Organic Chemistry I. 3 Credit Hours.**

This course is typically offered in Fall, Spring, and Summer I.

Structure, synthesis, and reactivity of hydrocarbons and their simple derivatives. Principles of organic spectroscopy and stereochemistry. Introductory study of kinetics and reaction mechanisms.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

CHEM 1032|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 1042|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 1952|Minimum Grade of C-|May not be taken concurrently.

**CHEM 2202. Organic Chemistry II. 3 Credit Hours.**

This course is typically offered in Fall, Spring, Summer I and Summer II.

Detailed examination of the more common functional groups and their reaction chemistry. Emphasis on development of organochemical reasoning powers through planning of multi-step syntheses and solution of structural problems by the combination of chemical and spectroscopic methods. Applications of organic chemistry to biological systems.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

CHEM 2201|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 2211|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 2921|Minimum Grade of C-|May not be taken concurrently.

**CHEM 2203. Organic Chemistry Laboratory I. 1 Credit Hour.**

This course is typically offered in Fall, Spring, and Summer I.

An introduction to microscale laboratory techniques in organic chemistry. Emphasis on learning to manipulate equipment and on efficient separation and purification of organic compounds.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 1034|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 1044|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 1954|Minimum Grade of C-|May not be taken concurrently)  
AND (CHEM 2201|Minimum Grade of C-|May be taken concurrently  
OR CHEM 2211|Minimum Grade of C-|May be taken concurrently  
OR CHEM 2921|Minimum Grade of C-|May be taken concurrently)

**CHEM 2204. Organic Chemistry Laboratory II. 1 Credit Hour.**

This course is typically offered in Fall, Spring, Summer I and Summer II.

A continuation of Chemistry 2203 (0123). Preparation, purification, and analysis, including multi-step sequences, of typical moderately complicated organic compounds.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 2203|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 2213|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 2923|Minimum Grade of C-|May not be taken concurrently)  
AND (CHEM 2202|Minimum Grade of C-|May be taken concurrently  
OR CHEM 2212|Minimum Grade of C-|May be taken concurrently  
OR CHEM 2922|Minimum Grade of C-|May be taken concurrently)

**CHEM 2211. Organic Chemistry for Majors I. 3 Credit Hours.**

This course is typically offered in Fall.

Structure, synthesis, and reactivity of hydrocarbons and their simple derivatives. Principles of organic spectroscopy and stereochemistry. Introductory study of kinetics and reaction mechanisms. Presentation focused on topics of interest to the professional chemist.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

CHEM 1032|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 1042|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 1952|Minimum Grade of C-|May not be taken concurrently.

**CHEM 2212. Organic Chemistry for Majors II. 3 Credit Hours.**

This course is typically offered in Spring.

Detailed examination of the more common functional groups and their reaction chemistry. Emphasis on development of organochemical reasoning powers through planning of multi-step syntheses and solution of structural problems by the combination of chemical and spectroscopic methods. Applications of organic chemistry to the chemical profession.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

CHEM 2201|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 2211|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 2921|Minimum Grade of C-|May not be taken concurrently.

**CHEM 2213. Organic Majors Laboratory I. 1 Credit Hour.**

This course is typically offered in Fall.

Introduction to organic chemical laboratory techniques, including spectroscopy and chromatography. Hands-on approach with individualized demonstration and instruction.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 1034|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 1044|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 1954|Minimum Grade of C-|May not be taken concurrently)  
AND (CHEM 2201|Minimum Grade of C-|May be taken concurrently  
OR CHEM 2211|Minimum Grade of C-|May be taken concurrently  
OR CHEM 2921|Minimum Grade of C-|May be taken concurrently)

**CHEM 2214. Organic Majors Laboratory II. 1 Credit Hour.**

This course is typically offered in Spring.

Advanced organic chemical laboratory techniques, including spectroscopy and chromatography. Hands-on approach with individualized demonstration and instruction.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 2203|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 2213|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 2923|Minimum Grade of C-|May not be taken concurrently)  
AND (CHEM 2202|Minimum Grade of C-|May be taken concurrently  
OR CHEM 2212|Minimum Grade of C-|May be taken concurrently  
OR CHEM 2922|Minimum Grade of C-|May be taken concurrently)

**CHEM 2251. Basic Core Organic Chemistry. 3 Credit Hours.**

This course is typically offered in Fall.

This is a one-semester version of organic chemistry for post-baccalaureate students. It includes the chemistry of alkanes, alkenes, alkynes, alcohols, amines, alkyl halides, ethers, aromatic rings, aldehydes, ketones, carboxylic acids, esters, and amides. These topics will be covered with special consideration of their relevance to the health sciences.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 1052|Minimum Grade of C|May not be taken concurrently)

AND (CHEM 1054|Minimum Grade of C|May not be taken concurrently)

**CHEM 2253. Basic Core Organic Chemistry Lab. 1 Credit Hour.**

This course is typically offered in Fall.

This is the laboratory component of a one-semester version of organic chemistry for post-baccalaureate students. It includes the chemistry of alkanes, alkenes, alkynes, alcohols, amines, alkyl halides, ethers, aromatic rings, aldehydes, ketones, carboxylic acids, esters, and amides. These topics will be covered with special consideration of their relevance to the health sciences.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 2251|Minimum Grade of C|May be taken concurrently)

AND (CHEM 1054|Minimum Grade of C|May not be taken concurrently)

**CHEM 2891. Introduction to Undergraduate Research. 1 Credit Hour.**

This course is typically offered in Fall and Spring.

Study and research under supervision of a member of the Chemistry faculty. Open to sophomore chemistry and biochemistry majors, others with permission of the department. The student is expected to gain an introduction to research through participating in limited independent research (3-4 hours/week) and participating in group research activities. A group presentation is required, the content of which is to be determined in consultation with the Research Mentor. A final written report will be submitted to the faculty member, who will forward a copy to the Department's Undergraduate Research Coordinator. Students are responsible for arranging their program and submitting reports with lead-time sufficient that registration and grading can be accomplished normally. NOTE: For further information and details, contact the Undergraduate Research Coordinator. This course does not fulfill an advanced Chemistry course for the Chemistry B.A. or B.S. degree. This course is repeatable for credit.

**Repeatability:** This course may be repeated for additional credit.

**CHEM 2921. Organic Chemistry for Honors I. 3 Credit Hours.**

This course is typically offered in Fall.

Structure, synthesis, and reactivity of hydrocarbons and their simple derivatives. Principles of organic spectroscopy and stereochemistry. Introductory study of kinetics and reaction mechanisms. Presentation focused on topics of interest to the professional chemist. NOTE: This course can be used to satisfy the university Core Science & Technology First Level (SA) requirement.

**Cohort Restrictions:** Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR.

**Course Attributes:** HO, SA

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

CHEM 1032|Minimum Grade of C-|May not be taken concurrently

OR CHEM 1042|Minimum Grade of C-|May not be taken concurrently

OR CHEM 1952|Minimum Grade of C-|May not be taken concurrently.

**CHEM 2922. Organic Chemistry for Honors II. 3 Credit Hours.**

This course is typically offered in Spring.

Detailed examination of the more common functional groups and their reaction chemistry. Emphasis on development of organochemical reasoning powers through planning of multi-step syntheses and solution of structural problems by the combination of chemical and spectroscopic methods. Applications of organic chemistry to the chemical profession. NOTE: This course can be used to satisfy the university Core Science & Technology Second Level (SB) requirement.

**Cohort Restrictions:** Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR.

**Course Attributes:** HO, SB

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

CHEM 2201|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 2211|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 2921|Minimum Grade of C-|May not be taken concurrently.

**CHEM 2923. Organic Honors Laboratory I. 1 Credit Hour.**

This course is typically offered in Fall.

Introduction to organic chemical laboratory techniques, including spectroscopy and chromatography. Hands-on approach with individualized demonstration and instruction. NOTE: This course can be used to satisfy the university Core Science & Technology First Level (SA) requirement.

**Cohort Restrictions:** Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR.

**Course Attributes:** HO, SA

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 1034|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 1044|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 1954|Minimum Grade of C-|May not be taken concurrently)  
AND (CHEM 2201|Minimum Grade of C-|May be taken concurrently  
OR CHEM 2211|Minimum Grade of C-|May be taken concurrently  
OR CHEM 2921|Minimum Grade of C-|May be taken concurrently)

**CHEM 2924. Organic Honors Laboratory II. 1 Credit Hour.**

This course is typically offered in Spring.

Advanced organic chemical laboratory techniques, including spectroscopy and chromatography. Hands-on approach with individualized demonstration and instruction. NOTE: This course can be used to satisfy the university Core Science & Technology Second Level (SB) requirement.

**Cohort Restrictions:** Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR.

**Course Attributes:** HO, SB

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 2203|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 2213|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 2923|Minimum Grade of C-|May not be taken concurrently)  
AND (CHEM 2202|Minimum Grade of C-|May be taken concurrently  
OR CHEM 2212|Minimum Grade of C-|May be taken concurrently  
OR CHEM 2922|Minimum Grade of C-|May be taken concurrently)

**CHEM 3001. Inorganic Chemistry. 3 Credit Hours.**

This course is typically offered in Fall and Spring.

Structure and bonding of inorganic compounds. Introduction to symmetry and group theory. Nomenclature. Descriptive chemistry of the main group elements. Introduction to transition metal chemistry and solid state materials. Mode: Three hours lecture and one hour recitation per week.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

CHEM 2201|Minimum Grade of C-|May not be taken concurrently

OR CHEM 2211|Minimum Grade of C-|May not be taken concurrently

OR CHEM 2921|Minimum Grade of C-|May not be taken concurrently.

**CHEM 3091. Research Methods. 3 Credit Hours.**

This course is typically offered in Spring.

Research Methods is required for all of the TUteach with Teaching majors. It is one of several content courses specially designed to meet the needs of future teachers. Sections meet two hours per week for non-traditional, interactive lectures and two hours per week for lab. The course is cross-listed in Biology, Chemistry, Earth and Environmental Science, and Physics. The goals of the course are (1) to provide students with the tools that scientists use to solve scientific problems; (2) to give students the opportunity to use these tools in a laboratory setting; (3) to make students aware of how scientists communicate with each other through peer-reviewed scientific literature; and (4) to enable students to understand how scientists develop new knowledge and insights, the most important of which are eventually presented in textbooks and taught in conventional science classes. Students design and carry out four independent inquiries, which they write up and present in the manner that is common in the scientific community. The inquiries incorporate mathematics and the various science disciplines, thus the team of instructors teaching this course have expertise in different disciplines and are available to supervise all students as they work on their inquiries in the lab. The combination of Research Methods and the TUteach course "Perspectives on Science and Mathematics" (Philosophy 2196) provides prospective science and mathematics teachers with an in-depth understanding of how the scientific enterprise works. NOTE: Chemistry 3091 is only available for major credit in the Chemistry with Teaching BS program.

**College Restrictions:** Must be enrolled in one of the following Colleges: Science & Technology.

**Repeatability:** This course may be repeated for additional credit.

**Pre-requisites:**

SCTC 1289|Minimum Grade of C-|May not be taken concurrently

OR SCTC 1389|Minimum Grade of C-|May not be taken concurrently.

**CHEM 3103. Techniques of Chemical Measurement I. 3 Credit Hours.**

This course is typically offered in Fall, Spring, and Summer I.

Introduction to the theory of instrumental analytical methods, with particular emphasis on equilibria and acid-base techniques. Application of statistics and error analysis to the design and execution of experiments, and writing and presenting scientific reports and papers. NOTE: Enrollment limited to students with declared concentration in chemistry or biochemistry.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 1032|Minimum Grade of C-|May not be taken concurrently

OR CHEM 1042|Minimum Grade of C-|May not be taken concurrently

OR CHEM 1952|Minimum Grade of C-|May not be taken concurrently)

AND (CHEM 1034|Minimum Grade of C-|May not be taken concurrently

OR CHEM 1044|Minimum Grade of C-|May not be taken concurrently

OR CHEM 1954|Minimum Grade of C-|May not be taken concurrently)

AND (MATH 1042|Minimum Grade of C|May not be taken concurrently

OR MATH 1044|Minimum Grade of C|May not be taken concurrently

OR MATH 1942|Minimum Grade of C|May not be taken concurrently

OR MATH 1951|Minimum Grade of C|May not be taken concurrently

OR MATH 2043 to 3080| Required Courses:1|Minimum Grade of C-|May be taken concurrently

OR MA07 Y|May not be taken concurrently)

**CHEM 3105. Introduction to Chemical Research Techniques. 1 Credit Hour.**

This course is typically offered in Fall, Spring, and Summer I.

Introduction to the application of instrumental analytical methods, with particular emphasis on equilibria and acid-base techniques. Written scientific reports will require a quantitative analysis of collected data, including statistics and error analyses. NOTE: Enrollment limited to students with declared concentration in chemistry or biochemistry.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 1032|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 1042|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 1952|Minimum Grade of C-|May not be taken concurrently)  
AND (CHEM 1034|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 1044|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 1954|Minimum Grade of C-|May not be taken concurrently)  
AND (MATH 1042|Minimum Grade of C|May not be taken concurrently  
OR MATH 1044|Minimum Grade of C|May not be taken concurrently  
OR MATH 1942|Minimum Grade of C|May not be taken concurrently  
OR MATH 1951|Minimum Grade of C|May not be taken concurrently  
OR MATH 2043 to 3080| Required Courses:1|Minimum Grade of C-|May be taken concurrently  
OR MA07 Y|May not be taken concurrently)  
AND (CHEM 3103|Minimum Grade of C-|May be taken concurrently)

**CHEM 3301. Physical Chemistry Lecture I. 3 Credit Hours.**

This course is typically offered in Fall and Spring.

Chemistry 3301 (0231) provides the foundation essential for most higher-level work in chemistry. Topics covered include thermodynamics, phase equilibria, chemical equilibria, kinetic theory of gases, chemical kinetics, and equilibrium electrochemistry.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 1032|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 1042|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 1952|Minimum Grade of C-|May not be taken concurrently)  
AND (MATH 2043|Minimum Grade of C-|May be taken concurrently  
OR MATH 3043 to 3044| Required Courses:1|Minimum Grade of C-|May be taken concurrently  
OR MATH 3137 to 3142| Required Courses:1|Minimum Grade of C-|May be taken concurrently  
OR MATH 4051 to 4063| Required Courses:1|Minimum Grade of C-|May be taken concurrently)  
AND (PHYS 1062|Minimum Grade of C-|May be taken concurrently  
OR PHYS 2022|Minimum Grade of C-|May be taken concurrently  
OR PHYS 2922|Minimum Grade of C-|May be taken concurrently  
OR PHYS 2101 to 2701| Required Courses:1|Minimum Grade of C-|May be taken concurrently  
OR PHYS 3101 to 3701| Required Courses:1|Minimum Grade of C-|May be taken concurrently  
OR PHYS 4101 to 4796| Required Courses:1|Minimum Grade of C-|May be taken concurrently)

**CHEM 3302. Physical Chemistry Lecture II. 3 Credit Hours.**

This course is typically offered in Fall and Spring.

An introduction to quantum mechanics and spectroscopy. NOTE: Although it is recommended that physical chemistry courses be taken in sequence [i.e., 3301 (0231) followed by 3302 (0232)], this course may be taken prior to Chemistry 3301 (0231).

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 1032|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 1042|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 1952|Minimum Grade of C-|May not be taken concurrently)  
AND (MATH 2043|Minimum Grade of C-|May be taken concurrently  
OR MATH 3043 to 3044| Required Courses:1|Minimum Grade of C-|May be taken concurrently  
OR MATH 3137 to 3142| Required Courses:1|Minimum Grade of C-|May be taken concurrently  
OR MATH 4051 to 4063| Required Courses:1|Minimum Grade of C-|May be taken concurrently)  
AND (PHYS 1062|Minimum Grade of C-|May be taken concurrently  
OR PHYS 2022|Minimum Grade of C-|May be taken concurrently  
OR PHYS 2922|Minimum Grade of C-|May be taken concurrently  
OR PHYS 2101 to 2701| Required Courses:1|Minimum Grade of C-|May be taken concurrently  
OR PHYS 3101 to 3701| Required Courses:1|Minimum Grade of C-|May be taken concurrently  
OR PHYS 4101 to 4796| Required Courses:1|Minimum Grade of C-|May be taken concurrently)

**CHEM 3397. Physical Chemistry Laboratory I. 2 Credit Hours.**

This course is typically offered in Fall and Spring.

A laboratory-based exploration of the fundamental physical and chemical principles involved in thermodynamics, chemical equilibria, colligative properties, and electrochemistry. The material complements topics covered in CHEM 3301. Special emphasis is placed on physical measurements followed by computer-aided analysis of data and errors. This writing-intensive course gives the student experience in generating technical reports as preparation for a professional career in Chemistry. NOTE: Capstone writing course.

**Course Attributes:** WI

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 3103|Minimum Grade of C-|May not be taken concurrently  
AND CHEM 3105|Minimum Grade of C-|May not be taken concurrently  
AND CHEM 3301|Minimum Grade of C-|May not be taken concurrently)

**CHEM 3398. Physical Chemistry Laboratory II. 2 Credit Hours.**

This course is typically offered in Fall and Spring.

A laboratory-based exploration of the fundamental physical and chemical principles involved in quantum mechanics, spectroscopy, and chemical kinetics. The material complements topics covered in CHEM 3302. Special emphasis is placed on physical measurements followed by computer-aided analysis of data and errors. This writing-intensive course gives the student experience in generating technical reports as preparation for a professional career in Chemistry. NOTE: Capstone writing course.

**Course Attributes:** WI

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 3103|Minimum Grade of C-|May not be taken concurrently  
AND CHEM 3105|Minimum Grade of C-|May not be taken concurrently  
AND CHEM 3302|Minimum Grade of C-|May not be taken concurrently)

**CHEM 3405. Physical Chemistry of Biomolecules. 3 Credit Hours.**

This course is typically offered in Spring.

CHEM 3405 is a lecture/recitation based survey course that covers those aspects of physical chemistry of use to biochemists in understanding the physical properties of biologically significant molecules and structures. Topics to be covered include thermodynamics, colligative properties of matter, electrolytes, enzyme kinetics, quantum theory, and spectroscopy. Note: Not for Chemistry majors.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 1032|Minimum Grade of C-|May not be taken concurrently

OR CHEM 1042|Minimum Grade of C-|May not be taken concurrently

OR CHEM 1952|Minimum Grade of C-|May not be taken concurrently)

AND (MATH 2043|Minimum Grade of C-|May be taken concurrently

OR MATH 3043 to 3044| Required Courses:1|Minimum Grade of C-|May be taken concurrently

OR MATH 3137 to 3142| Required Courses:1|Minimum Grade of C-|May be taken concurrently

OR MATH 4051 to 4063| Required Courses:1|Minimum Grade of C-|May be taken concurrently)

AND (PHYS 1062|Minimum Grade of C-|May be taken concurrently

OR PHYS 2022|Minimum Grade of C-|May be taken concurrently

OR PHYS 2922|Minimum Grade of C-|May be taken concurrently

OR PHYS 2101 to 2701| Required Courses:1|Minimum Grade of C-|May be taken concurrently

OR PHYS 3101 to 3701| Required Courses:1|Minimum Grade of C-|May be taken concurrently

OR PHYS 4101 to 4796| Required Courses:1|Minimum Grade of C-|May be taken concurrently)

AND (CHEM 4401|Minimum Grade of C-|May be taken concurrently)

**CHEM 3881. Cooperative Research. 2 to 4 Credit Hours.**

This course is typically offered in Fall, Spring, Summer I, and Summer II.

Independent study and research at Temple University outside of the Chemistry Department or at an off-campus laboratory facility under joint supervision of a member of the Temple Chemistry faculty and a Research Mentor at the laboratory facility. The class also meets one hour per week with the Undergraduate Research Coordinator to discuss report writing, searching the scientific literature, and proper research scholarship. Open to junior and senior chemistry and biochemistry majors, others with departmental approval. Credit may be offered for research during full-time off-campus employment. A final written report will be evaluated and endorsed by the research mentor and forwarded to the Department's Undergraduate Research Coordinator for final grade assignment. Students are responsible for arranging their programs and submitting reports with sufficient lead-time that registration and grading can be accomplished normally. NOTE: For further information and details, contact the Undergraduate Research Coordinator. CHEM 3881 can count as 1 of the 3 advanced laboratory courses required for the degree to be certified by the American Chemical Society. It will fulfill an Advanced Science elective for the Chemistry B.A. or B.S. degree. It will not fulfill an Advanced Chemistry elective for either Chemistry degree. Biochemistry majors may use CHEM 3881 as the first of two research courses towards satisfying one Biochemistry major elective.

**Repeatability:** This course may not be repeated for additional credits.

**CHEM 3891. Undergraduate Research. 2 to 4 Credit Hours.**

This course is typically offered in Fall, Spring, Summer I, and Summer II.

Independent study and research under the supervision of a member of the Chemistry faculty. The class also meets one hour per week with the Undergraduate Research Coordinator to discuss report writing, searching the scientific literature, and proper research scholarship. Open to junior and senior chemistry and biochemistry majors, others with permission of the department. A final written report will be evaluated by the faculty mentor and forwarded to the Department's Undergraduate Research Coordinator for final grade assignment. Students are responsible for arranging their program and submitting reports with sufficient lead-time that registration and grading can be accomplished normally. NOTE: For further information and details, contact the Undergraduate Research Coordinator. CHEM 3891 can count as 1 of the 3 advanced laboratory courses required for the degree to be certified by the American Chemical Society. It will fulfill an Advanced Science elective for the Chemistry B.A. or B.S. degree. It will not fulfill an Advanced Chemistry elective for the Chemistry B.A. or B.S. degree. Biochemistry majors may use CHEM 3891 as the first of two research courses towards satisfying one Biochemistry major elective.

**Repeatability:** This course may not be repeated for additional credits.

**CHEM 4002. Advanced Inorganic Chemistry. 3 Credit Hours.**

This course is not offered every year.

Group theory and its applications to chemical systems. Molecular orbital theory and spectroscopy. Descriptive chemistry of transition metal and organometallic compounds. Mode: Three hours lecture and one hour recitation per week.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 3001|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 4001|Minimum Grade of C-|May not be taken concurrently)  
AND (CHEM 3301|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 3302|Minimum Grade of C-|May not be taken concurrently)

**CHEM 4003. Inorganic Synthesis. 4 Credit Hours.**

This course is typically offered in Fall and Spring.

Introduction to preparative techniques and spectroscopic techniques used in contemporary inorganic chemistry. NOTE: This course can count as one of the three advanced laboratory courses required for the degree to be certified by the American Chemical Society. Mode: One hour lecture and six hours laboratory per week.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 3001|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 4001|Minimum Grade of C-|May not be taken concurrently)  
AND (CHEM 3301|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 3302|Minimum Grade of C-|May not be taken concurrently)

**CHEM 4004. Crystallography and Diffraction. 4 Credit Hours.**

This course is typically offered in Spring.

Students will learn the theory and practice of crystal structure determination by the method of single-crystal X-ray diffraction. Students will become independently competent in each stage of the crystal structure data collection, solution, and refinement processes, and will understand the theory behind each stage, as well as how to overcome common pitfalls. NOTE: This course can count as one of the three advanced laboratory courses required for the degree to be certified by the American Chemical Society. Mode: Two hours lecture and three hours laboratory per week.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 3001|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 4001|Minimum Grade of C-|May not be taken concurrently)  
AND (CHEM 3301|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 3302|Minimum Grade of C-|May not be taken concurrently)

**CHEM 4103. Instrumental Design. 4 Credit Hours.**

This course is typically offered in Fall.

This course covers method development for the analysis of complex organic mixtures. The analytical techniques detailed are High Performance Liquid Chromatography (HPLC), Gas Liquid Chromatography (GLC), and other appropriate chromatographic methodologies. NOTE: This course can count as one of the three advanced laboratory courses required for the degree to be accredited by the American Chemical Society.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 3103|Minimum Grade of C-|May not be taken concurrently)  
AND (CHEM 3105|Minimum Grade of C-|May not be taken concurrently)  
AND (CHEM 4196|Minimum Grade of C-|May be taken concurrently)

**CHEM 4107. Drug Analysis. 4 Credit Hours.**

This course is not offered every year.

Analytical techniques with specific applications to drug substances.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 3103|Minimum Grade of C-|May not be taken concurrently)

AND (CHEM 3105|Minimum Grade of C-|May not be taken concurrently)

AND (CHEM 3301|Minimum Grade of C-|May not be taken concurrently)

AND (CHEM 4196|Minimum Grade of C-|May not be taken concurrently)

**CHEM 4108. Investigative Chemistry. 4 Credit Hours.**

This course is typically offered in Spring.

This course will challenge students to perform chemical analyses on a variety of samples that may be considered as evidence. Students will be instructed in methodology and method validation. An understanding of data statistics and representation of data through use of spreadsheets will be emphasized. This course will introduce students to modern chemical instrumentation and techniques as applied to forensic issues.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 3103|Minimum Grade of C-|May not be taken concurrently)

AND (CHEM 3105|Minimum Grade of C-|May not be taken concurrently)

AND (CHEM 4196|Minimum Grade of C-|May not be taken concurrently)

**CHEM 4196. Techniques of Chemical Measurement II. 5 Credit Hours.**

This course is typically offered in Fall and Spring.

This course provides an introduction to modern applications of chromatography and spectroscopy. Laboratory assignments involve quantitative and qualitative analyses of inorganic and organic molecules. Instrumentation design, operating principles, and theory will be presented as they apply to uv-vis, nmr, fluorescence, epr, aa, ae, gc, gc-ms, gpc, and hplc. NOTE: Capstone writing course.

**Course Attributes:** WI

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 3103|Minimum Grade of C-|May not be taken concurrently)

AND (CHEM 3105|Minimum Grade of C-|May not be taken concurrently)

AND (CHEM 3301|Minimum Grade of C-|May not be taken concurrently)

OR CHEM 3302|Minimum Grade of C-|May not be taken concurrently)

AND (CHEM 3301|Minimum Grade of C-|May be taken concurrently)

OR CHEM 3302|Minimum Grade of C-|May be taken concurrently)

**CHEM 4201. Organic Structure and Mechanisms. 3 Credit Hours.**

This course is typically offered in Fall.

A problem-oriented course in organic structure, stereochemistry, and reaction mechanisms. Introduction to efficient retrieval of information from the organochemical literature. Simple molecular orbital and HOMO/LUMO theory.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

CHEM 2202|Minimum Grade of C-|May not be taken concurrently

OR CHEM 2212|Minimum Grade of C-|May not be taken concurrently

OR CHEM 2922|Minimum Grade of C-|May not be taken concurrently.

**CHEM 4202. Organic Synthesis Methodology. 3 Credit Hours.**

This course is typically offered in Spring.

Modern approaches to efficiently designed multi-step syntheses of important compounds. Retrosynthetic analysis, synthons, chirons, and protecting groups. Evaluation and appreciation of landmark achievements in the field.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

CHEM 2202|Minimum Grade of C-|May not be taken concurrently

OR CHEM 2212|Minimum Grade of C-|May not be taken concurrently

OR CHEM 2922|Minimum Grade of C-|May not be taken concurrently.

**CHEM 4207. Advanced Organic Preparations. 4 Credit Hours.**

This course is typically offered in Spring.

This course emphasizes the preparation of organic compounds using methods currently used in the modern chemical laboratory. Literature sources and spectroscopic methods are extensively used. The safe use of aggressive reagents, the use of and the design of multistep syntheses are emphasized. The environmental impact of method choice is treated. NOTE: This course can count as one of the three advanced laboratory courses required for the degree to be certified by the American Chemical Society.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 2202|Minimum Grade of C-|May not be taken concurrently

OR CHEM 2212|Minimum Grade of C-|May not be taken concurrently

OR CHEM 2922|Minimum Grade of C-|May not be taken concurrently)

AND (CHEM 2204|Minimum Grade of C-|May not be taken concurrently

OR CHEM 2214|Minimum Grade of C-|May not be taken concurrently

OR CHEM 2924|Minimum Grade of C-|May not be taken concurrently)

**CHEM 4396. Physical Chemistry Laboratory. 4 Credit Hours.**

This course is typically offered in Fall and Spring.

A laboratory study of the fundamental physical and chemical principles involved in molecular spectroscopy, thermodynamics, and chemical kinetics, with particular emphasis on the techniques of physical measurement and the presentation of coherent laboratory reports. NOTE: Capstone writing course.

**Course Attributes:** WI

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 3103|Minimum Grade of C-|May not be taken concurrently)

AND (CHEM 3105|Minimum Grade of C-|May not be taken concurrently)

AND (CHEM 3301|Minimum Grade of C-|May not be taken concurrently

OR CHEM 3302|Minimum Grade of C-|May not be taken concurrently)

AND (CHEM 3301|Minimum Grade of C-|May be taken concurrently

OR CHEM 3302|Minimum Grade of C-|May be taken concurrently)

**CHEM 4401. Biochemistry I. 3 Credit Hours.**

This course is typically offered in Fall and Spring.

Emphasis on structure/function relationships in proteins and nucleic acids. Kinetics and catalytic mechanisms of enzymes. Replication and genetic manipulation of DNA. NOTE: This course is required for the degree to be certified by the American Chemical Society.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

CHEM 2202|Minimum Grade of C-|May not be taken concurrently

OR CHEM 2212|Minimum Grade of C-|May not be taken concurrently

OR CHEM 2922|Minimum Grade of C-|May not be taken concurrently.

**CHEM 4503. Introduction to Polymer Chemistry. 4 Credit Hours.**

This course is typically offered in Fall.

Polymers are ubiquitous in many new (scaffolds for tissue engineering, hip replacements) and old (textiles, engineering resins, flocculants) applications, and are often used in composites with inorganic materials. In order to better understand the use and novel developments of polymers, this course will provide the fundamentals of synthesis, polymer structure/property relationships, and characterization methods. There is a laboratory component to the course that will cover molecular weight and phase transition methods.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:**

(CHEM 2202|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 2212|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 2922|Minimum Grade of C-|May not be taken concurrently)  
AND (CHEM 3301|Minimum Grade of C-|May not be taken concurrently)

**CHEM 4881. Cooperative Research. 1 to 3 Credit Hour.**

This course is typically offered in Fall, Spring, Summer I, and Summer II.

Independent study and research at Temple University outside of the Chemistry Department or at an off-campus laboratory facility under joint supervision of a member of the Temple Chemistry faculty and a Research Mentor at the laboratory facility, to be taken after a minimum grade of C- in CHEM 3881 or CHEM 3891. Open to senior chemistry and biochemistry majors, others with departmental approval. Credit may be offered for research during full-time off-campus employment. A final written report will be evaluated and endorsed by the research mentor and forwarded to the Department's Undergraduate Research Coordinator for final grade assignment. Students are responsible for arranging their programs and submitting reports with lead-time sufficient that registration and grading can be accomplished normally. NOTE: For further information and details, contact the Undergraduate Research Coordinator. CHEM 4881 will not count as an advanced laboratory course required for the degree to be certified by the American Chemical Society and/or as an Advanced Science elective for the Chemistry B.A. or B.S. degree. CHEM 4881 will not fulfill an Advanced Chemistry elective for the Chemistry B.A. or B.S. degree. Biochemistry majors may use CHEM 4881 to satisfy one of the two major course electives.

**Repeatability:** This course may be repeated for additional credit.

**CHEM 4891. Undergraduate Research. 1 to 3 Credit Hour.**

This course is typically offered in Fall, Spring, Summer I, and Summer II.

Independent study and research under supervision of a member of the Chemistry faculty, to be taken after a minimum grade of C- in CHEM 3881 or CHEM 3891. Open to senior chemistry and biochemistry majors, others with the permission of the department. A final written report will be evaluated by the faculty mentor and forwarded to the Department's Undergraduate Research Coordinator for final grade assignment. Students are responsible for arranging their program and submitting reports with sufficient lead-time that registration and grading can be accomplished normally. NOTE: For further information and details, contact the Undergraduate Research Coordinator. CHEM 4891 will not count as an advanced laboratory course required for the degree to be certified by the American Chemical Society and/or as an Advanced Science elective for the Chemistry B.A. or B.S. degree. CHEM 4891 will not fulfill an Advanced Chemistry elective for the Chemistry B.A. or B.S. degree. Biochemistry majors may use CHEM 4891 to satisfy one of the two major course electives.

**Repeatability:** This course may be repeated for additional credit.