Course Outcomes

Chemistry:

Introduction to General Chemistry

1. Make predictions about the atomic structure and chemical properties of the elements based in their position in the periodic table.
2. Use standard names and symbols to represent elements, isotopes, ions, compounds, and chemical reactions.
3. Identify patterns in bonding, molecular geometry, and chemical reactions.
4. Explain the physical properties of solids, liquids, gases, and solutions.
5. Understand the principles of kinetics and thermodynamics as applied to the rates and equilibrium positions of chemical reactions.
6. Apply quantitative reasoning skills to determine quantities of matter and energy involved in physical and chemical changes

Introduction to General Chemistry Lab

1. Define chemistry as the study of the composition, structure, properties, and reactions of matter.
2. Identify methods and instruments that can be used to study chemistry.
3. Evaluate data generated by experimental methods for chemical characterization.
4. Apply quantitative reasoning skills to determine quantities of matter and energy involved in physical and chemical changes

General Chemistry

1. Explain the behavior of, and interactions between, matter and energy at the atomic and molecular levels.
2. Use standardized names and symbols to represent atoms, molecules, ions and chemical reactions.
3. Predict atomic structure, chemical bonding or molecular geometry based on accepted models.

4. Apply quantitative reasoning skills to determine quantities of matter and energy involved in physical and chemical changes.
5. Demonstrate competence in collecting and interpreting data in the laboratory.

General Chemistry [J

I. Explain the behavior of, and interactions between, matter and energy at the atomic and molecular levels.
2. Understand the principles of kinetics and thermodynamics as applied to rates and equilibrium positions of chemical reactions.
3. Use quantitative measures of solution concentration in describing colligative, acid-base, solubility, and electrochemical principles of aqueous solutions.
4. Interpret nuclear processes such as radioactivity, fission, and fusion in terms of kinetic and thermodynamic principles.
5. Demonstrate competency in collecting, interpreting, and reporting data in the laboratory.

Quantitative Analysis

For the topics solutions, laboratory concepts, experimental error, statistics and calibration curves, quality assurance, complex chemical equilibria and activities, acids and bases, titrations, electrochemistry, spectroscopy, and extraction and chromatography there will be demonstration of an *intermediate* competence in the following areas:

I. Conceptual understanding for the purpose of problem solving, predicting outcomes, explaining phenomena, and describing relationships.
2. Quantitative reasoning for the purpose of *calculating numerical values* associated with problem solving, predicting outcomes, explaining phenomena, and describing relationships.
3. Laboratory skills for the purpose of collecting, interpreting, analyzing, and reporting (in written form) chemical data

Organic Chemistry **I**

I. Predict the major and minor products of a variety of organic reactions with appropriate stereochemistry and regiochemistry.
2. Understand and reproduce accepted mechanisms of organic reactions including all intermediates, arrows, charges, and resonance structures.
3. Understand and interpret spectra (IR, 'H NMR, '3C NMR, Mass Spec., and UV-VIS) of organic molecules.
4. Name or draw the structure of an organic molecule using substitutive and/or functional class IUPAC nomenclature.
5. Devise reasonable high-yield synthesis of a target molecule from given organic starting materials.
6. Understand physical properties of organic molecules.
7. Perform a laboratory experiment using conventional equipment, instrumentation, and techniques and understand the principles well enough to interpret the data collected

Organic Chemistry **II**

1. Predict the major and minor products of a variety of organic reactions with appropriate stereochemistry and regiochemistry.
2. Understand and reproduce accepted mechanisms of organic reactions including all intermediates, arrows, charges, and resonance structures.
3. Understand and interpret spectra (IR, 'H NMR, ^{13}C NMR, Mass Spec., and UV-VIS) of organic molecules.
4. Name or draw the structure of an organic molecule using substitutive and/or functional class IUPAC nomenclature.
5. Devise reasonable high-yield synthesis of a target molecule from given organic starting materials.
6. Understand physical properties of organic molecules.
7. Perform a laboratory experiment using conventional equipment, instrumentation, and techniques and understand the principles well enough to interpret the data collected

Tech Writing in Chemical Lit

1. Become familiar with, and learn to effectively use, common electronic resources for searching the scientific literature.
2. Learn to communicate in writing scientific findings in a manner consistent with literature

   practices. Specifically,

   a. Become familiar with the common structure and format of a typical research article in the literature (Abstract, Introduction, Experimental/Methods, Results, Discussion, Summary)

   b. Learn to write in a style consistent with that found in the literature.

   c. Learn to properly incorporate tables and figures into aresearch article.

   d. Properly cite references in a research article using accepted literature formats.
3. Learn to adapt a written document for oral presentation. Specifically:

   a. Identify similarities and differences in oral vs. written delivery of research material.

   b. Learn effective steps for designing visual material (Power Point slides) for use in an oral presentation.

   c. Practice public speaking skills needed for oral technical presentations.
4. Learn how the process of peer-review is used in the chemical literature, and practice effective reviewing techniques when reading others' work.

Chemistry Teaching Methods

1. Develop the ability to organize a high school chemistry course.
2. Develop the ability to analyze and critique chemistry teaching methods.
3. Develop the ability to prepare and present chemistry material.
4. Develop a knowledge of the current best practices to assess learning in chemistry courses.
5. Develop a knowledge of the certification process.
6. Develop the knowledge to safely and efficiently manage the chemicals and supplies necessary to maintain an effective high school chemistry program.

Instrumental Analysis

1. In the major areas of spectroscopy, separations, mass spectrometry, and electrochemistry
   students will be able to:
2. Describe and understand the capabilities and limitations of instrumental methods
3. Explain the instrument components and principles of operation
4. Upon being introduced to the steps of the analytical process, students will be able to correctly select an analytical method and instrument meeting their use objectives.
5. Students will be able to use and interpret electronics, signal/noise ratio, and signal processing as required for chemical analysis

Physical Chemistry **I**

1. Investigate and understand the physical models underlying our current perception of atomic and molecular behavior at the most basic, fundamental level. Understand basic terminology of quantum chemistry and spectroscopy in context of these models.
2. Develop an ability to use conceptual and mathematical tools to express and predict atomic and molecular behavior.
3. Analyze and interpret experimental data using quantum mechanical models.
4. Culture a basic understanding of how computational chemistry can be used to determine atomic and molecular properties.
5. Increase critical reading and critical thinking abilities.

Student Research

This course is a laboratory and/or field experience in which the student performs meaningful research under the mentorship of a faculty member

Chemistry Internship

All chemistry majors must find and experience a work .internship. This would generally occurs the semester after their junior year or during their senior year. The experience could involve

working for a government agency, industry, an academic institution, or any organization that employs laboratory chemists on their staff. The credit for the internship would count as the capstone experience required for graduation. The student will have a contract agreement with the employer and be responsible to a faculty supervisor. Upon completion of the internship, a written report and a technical presentation will be made to the BYU-Idaho chemistry department as part of the requirement.