

Chemistry Programs Goals

5/09

The mission of the Chemistry major is to educate chemists who are ready for employment or graduate school. We aim to give our graduates a firm foundation in each of the sub-disciplines of chemistry (Organic, Inorganic, Physical, Analytical, and Biochemistry) and an appreciation for the relationships between these sub-disciplines.

Skills

1. Oral/Written Communication and Library Use

- 1.1. To locate chemical information using print and electronic media (CHE 341, 342, 321, 422, 560).
- 1.2. To organize, present and explain chemical information using oral, written and electronic media (CHE 309, 321, 422, 341, 342, 560).

2. Laboratory Skills

- 2.1. To work safely in the chemical laboratory and follow standard chemical handling and disposal procedures (all, especially CHE 342, 422).
- 2.2. To synthesize, purify and characterize compounds (CHE 130, 212, 213, 340).
- 2.3. To use of modern chemical instrumentation and have a working knowledge of their principles behind their operation (CHE 212, 213, 309, 422).
- 2.4. To make precise, accurate measurements in the laboratory and use standards to validate data (CHE 212, 213, 231, 309, 342, 442)
- 2.5. To calculate results using data collected in the laboratory, discuss the limitations of that data and present it in a formal written report (CHE 309, 341, 342, 321, 422).
- 2.6. To develop independence in the laboratory in planning and performing experiments (all).

3. Problem Solving

- 3.1. To derive chemical equations, choose the appropriate equation for a given set of conditions and make meaningful calculations (CHE 212, 213, 309, 341, 342, 321, 422).
- 3.2. To evaluate and analyze trends in data, to calculate quantities of interest, and draw conclusions based on theoretical models and experience (CHE 309, 321, 341, 342, 422).
- 3.3. To demonstrate critical thinking by the application of previously acquired knowledge to new chemical problems (all).

4. Applications and Historical Perspectives

- 4.1. To work in a courteous, professional manner with fellow students and faculty in a diverse environment (all).
- 4.2. To serve the community through outreach events (CHE 321, 422).
- 4.3. To apply chemical principles to practical problems and societal issues (CHE 321, 422, 560).
- 4.4. To understand how new theories are developed accordance with the scientific method (CHE 321, 422, 342).

Content

5. Atomic and Molecular Structure and Bonding:

- 5.1. To derive and explain the quantum mechanical basis for the structure of atoms and molecules (CHE 130, 212, 213, 341).
- 5.2. To use Lewis theory, valence bond theory, molecular orbital theory to predict molecular geometry, bond order, bond strength and related quantities (CHE 130, 212, 213, 308, 309, 340, 341, 441, 442).
- 5.3. To explain the principles and limitations of spectroscopic methods (UV/Vis, IR, NMR, AA) and interpret spectra collected in the laboratory (CHE 212, 213, 309, 340, 341, 422).

6. Intermolecular Interactions

- 6.1. To interpret phase diagrams and make predictions using phase diagrams (CHE 212, 231, 342).
- 6.2. To identify the intermolecular forces in a system (London, dipole/dipole, ionic, hydrogen bonding) (CHE 130, 212, 213, 231, 309, 342, 442).
- 6.3. To explain the role of intermolecular forces in solubility, chromatography, and the structure of biological molecules (CHE 130, 212, 213, 309, 342, 422).

7. Chemical Reactivity

- 7.1. To predict the products of chemical reactions: acid/base, redox, precipitation, addition, elimination, substitution, rearrangement (CHE 130, 212, 213, 231, 308, 309, 321, 340).
- 7.2. To propose reasonable syntheses for target compounds (CHE 212, 213, 340).
- 7.3. To identify the role of nucleophiles and electrophiles in organic and biochemical reactions (CHE 212, 213, 309, 340).
- 7.4. To make stoichiometry calculations (all).

8. Kinetics and Thermodynamics

- 8.1. To explain the effect of catalysts and reaction conditions for organic, inorganic and biochemical reactions (CHE 231, 309, 342).
- 8.2. To use experimental data to establish a rate law, derive the rate law predicted by a given mechanism and propose a reasonable reaction mechanism given an experimental rate law (CHE 212, 213, 321, 342, 442).
- 8.3. To calculate and explain the enthalpy, entropy, free energy, heat and work for chemical and physical changes (CHE 130, 212, 213, 231, 342).
- 8.4. To calculate the equilibrium constant for a reaction and predict the effect of changes in pressure, temperature and reaction or product concentration (CHE 212, 213, 309, 342).