**CWEO 4.1**

**Breadth and depth of knowledge:** Understanding the foundational content and philosophical assumptions of one’s specialized area of study

**ULO 2**

**Breadth and depth of knowledge** Develop knowledge common to the liberal arts and sciences in the fields of arts, humanities, natural sciences, and social sciences. Students will also develop specialized knowledge and disciplinary expertise

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Student Learning Outcome/Objective** | **Courses in which students receive feedback** | **Measure** | **Target** | **Timeline** |
| **Describe the fundamental principles and applications of chemistry**   * Describe the structure and composition of matter * Describe the major reaction types in chemistry * Apply fundamental principles from thermodynamics and kinetics to the study of chemical systems * Identify the splendor of God’s creation in the context of molecules, atoms, and electrons * Describe the role of chemistry in science and society | CHEM 105  CHEM 106  CHEM 309 | ACS First Term General Chemistry Exam  ACS General Chemistry Exam  ACS First Term Organic Chemistry Exam | > 60% percentile on each of these exams | Every fall  Every spring  Every fall |

**Pink is difference from BA Chem.**

**CWEO 4.3**

**Specialized skills:** Developing proficiency in one’s specialized area of study sufficient to pursue a career and/or continue education at the graduate level

**ULO 4.3**

**Specialized skills** Become proficient in the scholarship of their discipline and demonstrate specialized skills needed to pursue a career and/or graduate school

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Student Learning Outcome/Objective** | **Courses in which students receive feedback** | **Measure** | **Target** | **Timeline** |
| **Apply fundamental and advanced principles across multiple areas of chemistry**   * Use the theories of microscopic properties to explain macroscopic behavior * Explain the role of energy and chemical bonding in determining the structure and reactivity of molecules * Describe the theoretical basis for modern methods of analysis and separation * Apply the laws and principles of thermodynamics, kinetics, and quantum mechanics to chemical systems * Describe the chemistry of important groups of elements with emphasis on periodic trends * Demonstrate scientific thinking, problem solving skills, and the ability to think critically | CHEM 221,  CHEM 321  CHEM 310  CHEM 437  CHEM 438  CHEM 361  CHEM 342 | Comprehensive final exam  ACS Analytical Chemistry Exam  ACS Organic Chemistry Exam  ACS Thermodynamics Exam  ACS Quantum Mechanics Exam  ACS Inorganic Exam  Final Exam  ETS Major Field Test  Senior Skills Assessment  Alumni Survey | Mean ≥ 75%  ≥ 70th percentile  ≥ 70th percentile  ≥ 60th percentile  ≥ 60th percentile  ≥ 75th percentile  Mean ≥ 80%  ≥ 80 percentile  Average of 4 (of 5) on all outcomes  Positive feedback about preparation | Every fall  Every spring  Every spring  Every fall  Every other spring  Every other fall  Every other spring  To all graduates  End of program |
| **Work accurately and safely in the laboratory**   * Apply fundamental laboratory techniques to a variety of experiments * Read and follow written experimental protocols * Properly set up and safely manipulate laboratory equipment, glassware, and chemicals * Maintain accurate records of experimental work * Use computers for collecting and processing experimental data | Laboratory components of CHEM 105  CHEM 106  CHEM 309 | Incident reports  Lab notebook grades | Less than two incident reports in first year course  ≥ 80% on cumulative lab notebook grade | Evaluated in spring  Every fall |
| **Demonstrate advanced lab knowledge and skills**   * Apply various techniques for synthesizing organic and inorganic compounds, including planning the synthesis * Apply various wet and instrumental techniques for characterizing chemical compounds * Perform accurate and precise quantitative measurements * Analyze data statistically and assess reliability of results * Maintain legally defensible records of experimental work * Interpret experimental data and draw warranted conclusions * Use and understand modern instrumentation * Demonstrate proficiency with advanced lab technique, such as working under vacuum or anhydrous conditions * Use and understand various methods of molecular modeling for understanding structure and reactivity | Laboratory component of  CHEM 221  CHEM 310  CHEM 437  CHEM 342 | Lab component of grade  Assigned technique grade  Cumulative notebook grade  Lab component of grade  Lab component of grade  Senior skills assessment | ≥ 80%  ≥ 80%  ≥ 80%  ≥ 80%  ≥ 80%  Average of 4 (of 5) on all outcomes | Every fall  Every spring  Every fall  When course is taught  End of program |
| **Identify and respond appropriately to chemical safety issues**   * Anticipate, recognize, and respond properly to hazards of laboratory work * Find information on chemical hazards * Dispose of chemical waste safely | All courses.  CHEM 390 | Reported safety incidents  Safety Exercise | Less than 2 per year  Mean ≥ 85% | End of courses |

**CWEO 4.2**

**Scholarship:** Engaging in scholarship in one’s specialized area of study

**ULO 4.2**

**Specialized scholarship** Become proficient in the scholarship of their discipline and demonstrate specialized skills needed to pursue a career and/or graduate school

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Student Learning Outcome/Objective** | **Courses in which students receive feedback** | **Measure** | **Target** | **Timeline** |
| **Demonstrate research and communication skills needed in the discipline**   * Retrieve specific chemical information from the primary and secondary literature, including research articles, books, and databases * Read and understand peer-reviewed chemical literature (primary literature) * Regularly attend department seminars * Produce clear, high-quality writing for lab reports and literature reviews according to the conventions appropriate for the chemical profession * Present effective talks on chemical topics | CHEM 221  CHEM 390 / 490 | Formal lab report  Methods paper  Abstracts turned in for seminars | ≥ 80%  ≥ 80%  Summarize talks each semester of these courses | Every fall  In courses |

**CWEO 4.4**

**Intrapersonal Awareness:** Gaining an awareness of options for employment, voluntary service, and/or graduate education in one’s specialized area of study

**ULO 5**

**Self-Awareness** Gain awareness of identity, character, and vocational calling

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Student Learning Outcome/Objective** | **Courses in which students receive feedback** | **Measure** | **Target** | **Timeline** |
| **Identify ways careers in chemistry connect with God’s vocational call**   * Describe career options in chemistry and how these connect with God’s call on one’s life * Access career opportunities for persons with chemical training | CHEM 390, 490  Departmental Seminars | Senior skills assessment  Alumni survey | Average of 4 (of 5) on all outcomes  Positive feedback |  |

**CWEO 4.5**

**Faith knowledge & application:** Articulating how faith connects to one’s specialized area of study and to potential career options in that area of study

**ULO 3**

**Faith knowledge & application** Develop informed and mature convictions about Christian faith and practice

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Student Learning Outcome/Objective** | **Courses in which students receive feedback** | **Measure** | **Target** | **Timeline** |
| **Demonstrate the integration of faith and science**   * Define the goals and limitations of the scientific process * Recognize that the physical world is created and sustained by God and science is our tool to understand the physical world * Commit to ethical decision making, service, and faithful stewardship of natural resources | Introduced in all courses  CHEM 495 | Integration paper  Alumni survey | ≥ 75% using an established rubric  Positive feedback | End of CHEM 495 |