MAJOR IN CHEMISTRY - SECONDARY EDUCATION CONCENTRATION

Chemistry majors in the Secondary Education Concentration are eligible, upon graduation, to apply for certification to teach chemistry for grades 7-12 in the state of Maryland.

The Chemistry Secondary Education Concentration requires 125-127 units for completion. Students in this concentration must complete 98-100 required units in content and Towson UTeach courses and 27 units in Core Curriculum courses not satisfied by the major, earning a grade equivalent of 2.00 or higher in each course.

Formal Admission to Towson UTeach

Students should apply to Towson UTeach when they have met the following criteria:

- completion of a written application available online (http://www.towson.edu/uteach);
- completion of at least 45 college units;
- a minimum GPA of 3.00 in the last two years;
- a passing score on the Maryland State Department of Education Basic Skills Assessment Requirement (http://marylandpublicschools.org/about/Pages/DEE/Certification/testing_info/praxis1.aspx);
- completion of a Criminal History Disclosure Form. This form is to be notarized and submitted to the Towson UTeach Office.

Full-Time Internship in Towson UTeach

Students in a mathematics or science secondary education concentration complete their full-time internship in their final semester. The following requirements must be met for the final internship semester:

- a minimum GPA of 2.75 in content courses required for the major;
- a minimum GPA of 3.00 in required education courses;
- a minimum cumulative GPA of 3.00.

GPA calculations based on transcripts from all institutions of higher learning attended, including Towson University.

For more information see the Standards for Teacher Education (http://catalog.towson.edu/undergraduate/education/admission-teacher-education) page.

### Required Chemistry Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 131</td>
<td>GENERAL CHEMISTRY I LECTURE</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 131L</td>
<td>GENERAL CHEMISTRY I LABORATORY</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 132</td>
<td>GENERAL CHEMISTRY II LECTURE</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 132L</td>
<td>GENERAL CHEMISTRY II LABORATORY</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 210</td>
<td>ANALYTICAL CHEMISTRY</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 323</td>
<td>INORGANIC CHEMISTRY</td>
<td>4</td>
</tr>
<tr>
<td>or CHEM 351</td>
<td>BIOCHEMISTRY I</td>
<td></td>
</tr>
<tr>
<td>CHEM 331</td>
<td>ORGANIC CHEMISTRY I</td>
<td>10</td>
</tr>
<tr>
<td>&amp; CHEM 332</td>
<td>and ORGANIC CHEMISTRY II</td>
<td></td>
</tr>
<tr>
<td>CHEM 345</td>
<td>PRINCIPLES PHYSICAL CHEM</td>
<td>3</td>
</tr>
</tbody>
</table>

### Additional Science and Mathematics Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOL 121</td>
<td>PHYSICAL GEOLOGY</td>
<td>4</td>
</tr>
<tr>
<td>or ASTR 161</td>
<td>THE SKY AND THE SOLAR SYSTEM</td>
<td></td>
</tr>
<tr>
<td>BIOL 191 &amp; 191L</td>
<td>INTRODUCTORY BIOLOGY FOR HEALTH PROFESSIONS [LECTURE] and INTRODUCTORY BIOLOGY FOR HEALTH PROFESSIONS [LAB]</td>
<td>4</td>
</tr>
<tr>
<td>or BIOL 200 &amp; 200L</td>
<td>INTRODUCTION TO CELLULAR BIOLOGY AND GENETICS [LECTURE] and INTRODUCTION TO CELLULAR BIOLOGY AND GENETICS [LAB]</td>
<td></td>
</tr>
<tr>
<td>MATH 211</td>
<td>CALCULUS FOR APPLICATIONS</td>
<td>3</td>
</tr>
<tr>
<td>or MATH 273</td>
<td>CALCULUS I</td>
<td></td>
</tr>
<tr>
<td>PHYS 211 &amp; PHYS 212</td>
<td>GENERAL PHYSICS I; NON CALCULUS-BASED and GENERAL PHYSICS II; NON CALCULUS-BASED</td>
<td>8</td>
</tr>
<tr>
<td>or PHYS 241 &amp; PHYS 242</td>
<td>GENERAL PHYSICS I CALCULUS-BASED and GENERAL PHYSICS II CALCULUS-BASED</td>
<td></td>
</tr>
<tr>
<td>SCIE 380</td>
<td>TEACHING SCIENCE IN THE SECONDARY SCHOOLS</td>
<td>3</td>
</tr>
</tbody>
</table>

Students must also take a minimum of 4 units of electives from the following list:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 310</td>
<td>INSTRUMENTAL ANALYSIS</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 323</td>
<td>INORGANIC CHEMISTRY</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 346</td>
<td>THEORETICAL FOUNDATIONS OF PHYSICAL CHEMISTRY</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 351</td>
<td>BIOCHEMISTRY I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 356</td>
<td>BIOCHEMISTRY LAB</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 357</td>
<td>BIOCHEMISTRY II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 391</td>
<td>SPECIAL PROBLEMS IN CHEMISTRY I</td>
<td>1-3</td>
</tr>
<tr>
<td>CHEM 395</td>
<td>INTERNSHIP IN CHEMISTRY</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 461</td>
<td>ADVANCED LECTURE TOPICS</td>
<td>1-3</td>
</tr>
<tr>
<td>CHEM 462</td>
<td>ADVANCED LABORATORY TECHNIQUES</td>
<td>1-2</td>
</tr>
<tr>
<td>CHEM 472</td>
<td>APPLICATIONS OF ENVIRONMENTAL CHEMISTRY</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 480</td>
<td>CHEMICAL TOXICOLOGY</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 491</td>
<td>RESEARCH IN CHEMISTRY</td>
<td>1-3</td>
</tr>
<tr>
<td>FRSC 363</td>
<td>CHEMISTRY OF DANGEROUS DRUGS</td>
<td>3</td>
</tr>
<tr>
<td>FRSC 367</td>
<td>FORENSIC CHEMISTRY</td>
<td>3</td>
</tr>
</tbody>
</table>

1. Course cannot be counted as both part of the required courses and part of the electives.
2. Course has prerequisites not listed among the required courses.
SEMS 110 & SEMS 120
INTRODUCTION TO STEM TEACHING I: INQUIRY APPROACHES TO TEACHING and INTRODUCTION TO STEM TEACHING II: INQUIRY-BASED LESSON DESIGN

or SEMS 130
INTRODUCTION TO STEM TEACHING I & II COMBINED

*Permission of Towson UTeach Department required to take SEMS 130.

Core Courses
SEMS 230 KNOWING AND LEARNING 3
SEMS 240 CLASSROOMS INTERACTIONS 3
SEMS 250 PERSPECTIVES IN SCIENCE AND MATHEMATICS 3
SEMS 360 RESEARCH METHODS 3
SEMS 370 PROJECT-BASED INSTRUCTION 3
SEMS 498 INTERNSHIP IN MATHEMATICS AND SCIENCE SECONDARY EDUCATION 3
SCED 460 USING READING AND WRITING IN THE SECONDARY SCHOOLS 4
SCED 461 TEACHING READING IN THE SECONDARY CONTENT AREAS 3

Science Courses
SCIE 393 INTERNSHIP IN SECONDARY EDUCATION-SCIENCE 12
SCIE 430 SEMINAR IN STUDENT TEACHING - SCIENCE 1

Total Units 40

For further information, contact Sonali Raje (Smith Hall 528D, 410-704-4622; sraje@towson.edu.)

Students who decide not to complete all Towson UTeach Science requirements must complete all the requirements of the Chemistry major in order to graduate.

Suggested Four-Year Plan

Based on course availability and student needs and preferences, the selected sequences will probably vary from those presented below. Students should consult with their adviser to make the most appropriate elective choices.

Freshman
Term 1  Units Term 2  Units
CHEM 131 & 131L (Core 7)  4 CHEM 132 & 132L (Core 8)  4
GEOL 121 or ASTR 161 (Core 8)  4 Select one of the following:  4
MATH 211 or 273 (Core 3)  3-4 BIOL 191 & 191L
SEMS 110  1 BIOL 200 & 200L
Core 1 (or Core 2)  3 SEMS 120  1
  Core 2 (or Core 1)  3  Core 4  3

15-16 15

Sophomore
Term 1  Units Term 2  Units
CHEM 210  5 CHEM 332  5
CHEM 331  5 PHYS 212 or 242  4
PHYS 211 or 241  4 SEMS 240  3
SEMS 230  3 Core 6  3

17  15

Junior
Term 1  Units Term 2  Units
CHEM 323 or 351  4 CHEM 372  2
SEMS 250 (Core 5)  3 CHEM Elective  4
SCED 460  4 SCED 461  3
Core 10  3 SEMS 370  3
Core 11  3 Core 13  3

17  15

Senior
Term 1  Units Term 2  Units
CHEM 345  3 SCIE 393  12
CHEM 401  1 SCIE 430  1
SCIE 380  3
SEMS 360 (Core 9)  3
SEMS 498  3
Core 14  3

16  13

Total Units 123-124

NSTA Standard 1: Content Knowledge

Effective teachers of science understand and articulate the knowledge and practices of contemporary science. They interrelate and interpret important concepts, ideas, and applications in their fields of licensure. Below are the elements of the standard.

Pre-service teachers will:
1a) Understand the major concepts, principles, theories, laws, and interrelationships of their fields of licensure and supporting fields as recommended by the National Science Teachers Association.
1b) Understand the central concepts of the supporting disciplines and the supporting role of science-specific technology.
1c) Show an understanding of state and national curriculum standards and their impact on the content knowledge necessary for teaching P-12 students.

NSTA Standard 2: Content Pedagogy

Effective teachers of science understand how students learn and develop scientific knowledge. Pre-service teachers use scientific inquiry to develop this knowledge for all students. Below are the elements of the standard.

Pre-service teachers will:
2a) Plan multiple lessons using a variety of inquiry approaches that demonstrate their knowledge and understanding of how all students learn science.
2b) Include active inquiry lessons where students collect and interpret data in order to develop and communicate concepts and understand scientific processes, relationships and natural patterns from empirical experiences. Applications of science-specific technology are included in the lessons when appropriate.
2c) Design instruction and assessment strategies that confront and address naïve concepts/preconceptions.
Assessment: This Standard is usually met using Assessment 3 - Unit Plan.

**NSTA Standard 3: Learning Environments**

Effective teachers of science are able to plan for engaging all students in science learning by setting appropriate goals that are consistent with knowledge of how students learn science and are aligned with state and national standards. The plans reflect the nature and social context of science, inquiry, and appropriate safety considerations. Candidates design and select learning activities, instructional settings, and resources—including science-specific technology, to achieve those goals; and they plan fair and equitable assessment strategies to evaluate if the learning goals are met. Below are the elements of the standard.

Pre-service teachers will:

3a) Use a variety of strategies that demonstrate the candidates knowledge and understanding of how to select the appropriate teaching and learning activities including laboratory or field settings and applicable instruments and/or technology-to allow access so that all students learn. These strategies are inclusive and motivating for all students.

3b) Develop lesson plans that include active inquiry lessons where students collect and interpret data using applicable science-specific technology in order to develop concepts, understand scientific processes, relationships and natural patterns from empirical experiences. These plans provide for equitable achievement of science literacy for all students.

3c) Plan fair and equitable assessment strategies to analyze student learning and to evaluate if the learning goals are met. Assessment strategies are designed to continuously evaluate preconceptions and ideas that students hold and the understandings that students have formulated.

3d) Plan a learning environment and learning experiences for all students that demonstrate chemical safety, safety procedures, and the ethical treatment of living organisms within their licensure area.

Assessment:

**NSTA Standard 4: Safety**

Effective teachers of science can, in a P-12 classroom setting, demonstrate and maintain chemical safety, safety procedures, and the ethical treatment of living organisms needed in the P-12 science classroom appropriate to their area of licensure. Below are the elements of the standard.

Pre-service teachers will:

4a) Design activities in a P-12 classroom that demonstrate the safe and proper techniques for the preparation, storage, dispensing, supervision, and disposal of all materials used within their subject area science instruction.

4b) Design and demonstrate activities in a P-12 classroom that demonstrate an ability to implement emergency procedures and the maintenance of safety equipment, policies and procedures that comply with established state and/or national guidelines. Candidates ensure safe science activities appropriate for the abilities of all students.

4c) Design and demonstrate activities in a P-12 classroom that demonstrate ethical decision-making with respect to the treatment of all living organisms in and out of the classroom. They emphasize safe, humane, and ethical treatment of animals and comply with the legal restrictions on the collection, keeping, and use of living organisms.

**NSTA Standard 5: Impact on Student Learning**

Effective teachers of science provide evidence to show that P-12 students understanding of major science concepts, principles, theories, and laws have changed as a result of instruction by the candidate and that student knowledge is at a level of understanding beyond memorization. Candidates provide evidence for the diversity of students they teach. Below are the elements of the standard.

Pre-service teachers will:

5a) Collect, organize, analyze, and reflect on diagnostic, formative and summative evidence of a change in mental functioning demonstrating that scientific knowledge is gained and/or corrected.

5b) Provide data to show that P-12 students are able to distinguish science from non-science, understand the evolution and practice of science as a human endeavor, and critically analyze assertions made in

5c) Engage students in developmentally appropriate inquiries that require them to develop concepts and relationships from their observations, data, and inferences in a scientific manner.

**NSTA Standard 6: Professional Knowledge and Skills**

Effective teachers of science strive continuously to improve their knowledge and understanding of the ever changing knowledge base of both content, and science pedagogy, including approaches for addressing inequities and inclusion for all students in science. They identify with and conduct themselves as part of the science education community. Below are the elements of the standard.

Pre-service teachers will:

6a) Engage in professional development opportunities in their content field such as talks, symposiums, research opportunities, or projects within their community.

6b) Engage in professional development opportunities such as conferences, research opportunities, or projects within their community.