Program learning outcomes	Courses related to these learning outcomes	Assessment method	Measures/Criteria, Rubric	Data collection	Assessment cycle
BS Biochemistry					
1. Demonstrate a foundational understanding of organic, inorganic, analytical, and physical chemistry and advanced knowledge in biochemistry.	a. CHEM 2430/2440: Organic 1&2 b. CHEM 4500: Inorganic c. CHEM 2200: Analytical 1 d. CHEM 3330/3340: Physical 1&2 e. CHEM 4610/4620: Biochem 1&2	a. Overall percentile on ACS exam in Orgo 2 b. Total score on cumulative final exam c. Overall percentile on ACS exam d. Overall percentile on ACS exam in P. Chem 1 e. Overall percentile on ACS exam in Biochem 2	a,c-e. 66th percentile exceeds, 45-66 meets, 33-44 approaching, <33 does not meet b. For cumulative final: 90% exceeds, 80-89 meets, 70-79 approaching, <70 does not meet	Every offering	Year 1 of a 3-year cycle
2. Demonstrate proficiency of basic (general, organic, analytical, and physical) and advanced biochemistry laboratory techniques and conduct laboratory experiments safely.	a. CHEM 1115/1125: General 1&2 Lab b. CHEM 2430/2440: Organic 1&2 c. CHEM 2435/2445: Organic 1&2 Lab d. CHEM 2200: Analytical 1 e. CHEM 2200: Analytical 1 Lab f. CHEM 4610/4620: Biochem 1&2 g. CHEM 4615: Biochem 1 Lab h. CHEM 3330/3340: P Chem 1&2 i. CHEM 3345: P. Chem Lab	a. Score on Gen Chem 2 lab Boiling Point Elevation and score on safety exam in Gen Chem lab 1&2 b. Score on specific questions on ACS exam in Orgo 2 c. Technique points for Orgo 2 lab (Lab 7: E1/E2 Elimination) and score on safety exam in Orgo 1&2 d. Score on specific questions on ACS exam in Analytical 1 e. Semester score f. Score on specific questions on ACS exam in Biochem 2 g. Score on Results section for Biochem 1 lab (Unknown Amino Acid Identification Using Acid-Base Titrations and TLC) h. Score on specific questions on ACS exam in P. Chem 1 i. Semester score for P. Chem lab	a,c. 90% exceeds, 80-89 meets, 70-79 approaching, <70 does not meet. For safety exam, 80% or higher meets expectations, below 80% does not meet. b,d,f,h. If course % correct on each question meets or exceeds Diff Index provided by ACS, meets expectations. If below, does not meet. e,g,i. 90% exceeds, 80-89 meets, 70-79 approaching, <70 does not meet.	Every offering.	a,c,e,g,i. Year 2 of 3-year cycle b,d,f,h. Year 1 of a 3-year cycle
3. Collect, interpret, and analyze quantitative data.	a. CHEM 2430/2440: Orgo 1&2 b. CHEM 2200/4200: Analytical 1&2 c. CHEM 2205: Analytical 1 Lab d. CHEM 4610/4620: Biochem 1&2 e. CHEM 4615: Biochem 1 Lab f. CHEM 3330/3340: P. Chem 1&2 g. CHEM 3345: P. Chem Lab	a. Score on specific questions on ACS exam in Orgo 2 b. Score on specific questions on ACS analytical exam c. Semester score in Analytical 1 Lab d. Score on specific questions on ACS exam in Biochem 2 e. Score on Results, Discussion, and Conclusion sections of Biochem 1 lab (Unknown Amino Acid Identification Using Acid-Base Titrations and TLC) f. Score on specific questions on ACS exam in P. Chem 1 g. Semester score for P. Chem lab	a,b,d,f. If course % correct on each question meets or exceeds Diff Index provided by ACS, meets expectations. If below, does not meet. c,e,g. 90% exceeds, 80-89 meets, 70-79 approaching, <70 does not meet	Every offering.	a,b,d,f. Year 1 of 3-year cycle. c,e,g. Year 2 of 3-year cycle.
4. Communicate scientific results effectively, especially through written reports and oral presentations.	a. CHEM 2435: Orgo 1 Lab b. CHEM 3100: Chem Lit c. CHEM 3345: P Chem Lab d. CHEM 3970: Undergrad Research e. CHEM 4615: Biochem 1 Lab f. CHEM 4625: Biochem 2 Lab	a. Score on end of semester presentation in Orgo 1 Lab b. Score on Chem Lit presentation c. Semester score for P. Chem lab d. Written Communication VALUE rubric e. Score on Biochem 1 lab (Unknown Amino Acid Identification Using Acid-Base Titrations and TLC) f. Score for oral presentation and final lab report	a,b,c,e,f. 90% exceeds, 80-89 meets, 70-79 approaching, <70 does not meet d. A score of 3 or 4 in each category meets, scores below 3 do not meet.	Every offering.	a,c,e,f. Year 2 of 3-year cycle. b,d. Year 3 of 3-year cycle.
5. Design and conduct independent research	CHEM 3970: Undergrad research	Inquiry and Analysis VALUE rubric	A score of 3 or 4 in each category meets, scores below 3 do not meet.	Upon completion of undergrad thesis	Year 3 of 3-year cycle

	Mastery (3)	Meets Expectations (2)	Needs Development (1)	Score
Knowledge base	Has thorough knowledge of the background and motivation for project. Is familiar with relevant scientific literature.	Has a developing knowledge of the background and motivation for project. Has some familiarity with scientific literature.	Has an inadequate knowledge of the background and motivation for project. Has minimal familiarity with scientific literature.	
Technical skills	Is able to perform technical procedures and use instruments without assistance. Consistently reproduces high quality results.	Is able to perform technical procedures and use instruments with some assistance. Quality of results may be inconsistent.	Needs assistance performing technical procedures and using instruments. Consistently fails to reproduce results.	
Critical thinking and problem solving	Interprets data, draws reasonable conclusions, and proposes the next experiment. Solves problems and displays creativity.	Understands experimental methods and theoretical outcomes but is not able to draw conclusions or propose the next experiment. Needs some help solving problems.	Does not engage in critical analysis of experimental results. Always requires help to solve problems.	
Independence, time management, and planning	Works independently. Plans experiments and manages time proficiently. Always completes experiments in a timely manner.	Sometimes requires assistance planning experiments and managing time. Usually completes experiments in a timely manner.	Unable to work without supervision. Does not plan experiments or manage time proficiently. Does not complete experiments in a timely manner.	
Collegiality and collaboration	Works well with peers and supervisors. Applies constructive criticism to improve performance. Respects different points of view. Helps in the mentoring or training of others.	Works with peers and supervisors with minimal conflicts. Sometimes applies constructive criticism to improve performance. Usually respects different points of view.	Has several conflicts with peers and supervisors. Does not apply constructive criticism to improve performance. Does not respect different points of view.	
Record keeping	Keeps complete, organized, and legible notebook.	Keeps complete notebook, but it is disorganized or has legibility issues.	Does not keep complete notebook. Components are missing or inadequate.	
Terminology	Adheres to correct usage of chemical structures, formulas, equations, and terminology.	Makes minor mistakes in the usage of chemical structures, formulas, equations, and terminology.	Makes major mistakes in the usage of chemical structures, formulas, equations, and terminology.	
Communication	Prepares oral and written presentations that are complete, well-written or delivered, and formatted and referenced appropriately.	Prepares oral and written presentations that have minor errors in delivery, format, grammar, or citation. Improves with feedback and revision.	Prepares presentations that are incomplete, poorly written or delivered, incorrectly formatted, or missing references. Shows little improvement after feedback.	
Laboratory safety	Always follows correct safety procedures in the laboratory.	Follows correct safety procedures in the laboratory with minimal reminders.	Needs to be reminded repeatedly to engage in safe laboratory procedures.	
Productivity	Has made significant progress toward project completion.	Has made progress toward project completion.	Has made little progress toward project completion.	

 This blank rubric was designed for program assessment. Completed rubrics will not be returned to students nor will they be used to determine semester grades for CHEM 3970.

	Mastery (3)	Meets Expectations (2)	Needs Development (1)	Score
Arrangement of thesis	Information and text are arranged in a format that is typical of a publication in the field: Title, Introduction, Procedure, Results, Discussion, Conclusion, and References.	Information and text are arranged in a format that is typical of a publication in the field with only one section out of order or not included.	Information and text are not arranged in a format that is typical of a publication in the field.	
Arrangement of text	Text is arranged in a coherent, logical manner that is appropriate for the topic. Paragraphs are put together well with a coherent "flow." They are persuasive and connect to surrounding material.	Text is arranged in a logical manner appropriate for the topic. Paragraphs are put together well, but some lack a coherent "flow". Some are persuasive and connect to surrounding material.	Text is not arranged in a logical manner. Paragraphs lack a coherent "flow." They are not persuasive and do not connect to the surrounding material.	
Title	The title clearly identifies the **topic** and the **main point** of the thesis.	The title identifies the topic and gives a general idea of the main point.	The title does not identify the topic, or there is no title.	
Research Problem	The research problem meets the following criteria: is testable, is predictive, is specific, and looks at a particular question or theory.	The research problem meets all but one of the defined criteria.	The research problem does not meet two or more of the defined criteria.	
Introduction	Information relevant to the given topic is provided. The significance of the topic is clear to the reader.	Information relevant to the given topic is provided, but the significance of the topic is not clear to the reader.	Information provided is not relevant to the given topic. The significance of the topic is not clear to the reader.	
Materials and methods	The procedure is written in paragraph form and can reliably be repeated by another scientist. All materials/methods used in the laboratory are clearly indicated.	The procedure is written in paragraph form and can usually be repeated by another scientist. Most materials/methods used in the laboratory are clearly indicated.	The procedure is not written in paragraph form. Details are missing, and the procedure cannot be repeated by another scientist. Some materials/methods used in the laboratory are clearly indicated.	
Results	The results section describes all quantitative and qualitative observations from the laboratory. The data is tabulated and/or graphed in a way that is easy to comprehend. All tables and graphs are numbered, titled, and referenced.	The results section describes some quantitative and qualitative observations from the laboratory. The data is tabulated and/or graphed in a way that is potentially confusing. Tables and graphs are titled and referenced. Graphs are not always provided where applicable.	Significant quantitative and qualitative observations from the laboratory are missing. The data is tabulated and/or graphed in a way that is not easily comprehendible. Graphs of the given data are not provided where applicable.	
Discussion	All results and outside evidence are properly introduced and thoroughly discussed. Clear connections are built between all important pieces of information.	All results and some outside evidence are presented, but the discussion is not completely convincing. Some connections are built between important pieces of information.	Results and outside evidence are mentioned but not thoroughly discussed. No connections are built between important pieces of information.	
Conclusion	The conclusion is strong and well summarized. It leaves the reader with a clear and thorough understanding.	The conclusion is well summarized. It leaves the reader with a general understanding.	The conclusion is present but not well summarized. It leaves the reader without an understanding.	
Grammar/Spelling Error	The thesis is free from spelling and grammar errors; 0-5 errors can be identified.	The thesis is generally free from spelling and grammar errors; 6-10 errors can be identified.	The thesis has many spelling and grammar errors.	

Loosely adapted from a rubric in Rachel M. Coon's "A Compilation of Rubrics to be Used in Chemistry to Emphasize Argumentative Writing in the Science Classroom." This blank rubric was designed for program assessment. Completed rubrics will not be returned to students nor will they be used to determine semester grades for CHEM 3970.