

UNIVERSITY OF SAN FRANCISCO
College of Arts and Sciences

Chemistry—Program Assessment Plan

Program Goals

- Transmit to students a rigorous understanding of fundamental chemical concepts and techniques.
- Structure opportunities within the department for students to gain practical experience with a wide variety of chemistry instruments and to learn how to interpret data obtained from them.
- Develop students' abilities to communicate ideas in chemistry to general audiences and to specialists.
- Provide programs of instruction which lead to the B.S. degree and which enable students to begin either a career in science or to continue with study for a higher degree.

Program Learning Goals:

When USF students graduate from the chemistry program with a BS degree in chemistry or chemistry with a biochemistry emphasis, they should be able to:

- Identify and articulate foundational chemical principles of each sub-discipline in our curriculum.
- Solve typical theoretical and experimental problems in chemistry.
- Acquire and analyze data using experimental, computational and instrumental methods.
- Plan and perform chemical experiments, including running basic synthetic reactions and employing isolation and purification techniques.
- Find, organize and present valid scientific information in written and oral form assisted by the use of computer technology.
- Successfully pursue further studies or employment in chemistry, interdisciplinary areas involving chemistry or allied health professions.

Curriculum Mapping

Key: I = Introductory, D = In-Depth

Departmental Outcomes	Your Course Numbers																		
	111	113	230	231	232	233	260	330	340	341	350	351	352	356	397	410	420	450	
1.) Identify and articulate foundational chemical principles.																			
a. Across discipline	I	I									I	I	I			D		I	
c. Within a sub-discipline			D	D	I	D	D	D	D	D	D	D	D	I			D	D	
2.) Solve typical college level chemistry problems																			
a. Theoretical problem solving	I	I	D	D	I	D	D	D	D	D	D	D	D	I		D	D	D	
b. Experimental problem solving	I	I			I	D	D						D			D	D	D	
3.) Acquire and analyze data																			
a. Experimental data (non-instrumental)	I	I			I	D	D						D		D	D	D		
b. Computational data						D									D		D		
c. Instrumental data	I	I			I	D	D								D	D	D		
4.) Plan and perform chemical experiments																			
a. Basic synthesis	I				I	D									D		D		
b. Isolation techniques	I?				I	D							D		D		D		
c. Purification methods	I?				I	D							D		D		D		
5.) Acquire, organize and present scientific information																			
a. Written reports	I	I		I	I	D	D	I					D		D	D	D	D	
b. Oral presentations				I		I		D							D				
c. Database/literature searching				I	I	D		I					I		D	I	I	I	
6.) Successfully pursuer post-baccalaureate																			

* Outcome 6 is assessed by tracking students after they graduate

Chemistry Dept. Learning Outcomes Rubric

Outcome	Very Poor Achievement of Outcome	Poor Achievement of Outcome	Average Achievement of Outcome [Benchmark Standard]	Good Achievement of Outcome	Very Good Achievement of Outcome
Identify and articulate foundational chemical principles of each sub-discipline in our curriculum. Sub-disciplines include: organic, inorganic, analytical, physical and biological chemistry.	Cannot match foundational principles with particular subdisciplines. Cannot basically define given foundational principles such as kinetics, thermodynamics, metabolic pathway, etc.	Can identify basic foundational principles of at least three subdisciplines but cannot articulate them without significant input from an instructor.	Can identify and articulate the foundational principles of a majority of the subdisciplines without significant input from an instructor.	Can clearly distinguish, define and articulate foundational principles of all subdisciplines of chemistry with minor input from an instructor.	Can clearly distinguish, define and articulate Foundational principles of all subdisciplines of chemistry without prompting from an instructor.
Solve typical theoretical and experimental problems in chemistry.	Doesn't have a firm enough grasp on the mathematical, mechanistic or conceptual aspects of chemistry to know how to approach a problem to begin solving it. Doesn't know how to seek appropriate information from a text or other chemical literature that would aid in problem solving.	Given the appropriate theoretical framework (e.g., equation, reaction, pathway, etc.) or experimental method can solve relatively simple problems. Cannot solve more difficult problems without significant input from an instructor.	Given the appropriate theoretical framework (e.g., equation, reaction, pathway, etc.) or experimental method can solve > 50% of typical problems in a majority of the subdisciplines with minimal input from an instructor.	Given the appropriate theoretical framework (e.g., equation, reaction, pathway, etc.) or experimental method can solve a majority of typical problems at all levels of the curriculum with minimal input from an instructor.	Can determine the appropriate theoretical or experimental framework for solving undergraduate level chemistry problems. Can solve a majority of problems at all levels of the curriculum without any prompting from an instructor.
Acquire and analyze data using experimental, computational and instrumental methods.	Given the appropriate experimental, instrumental or computational context to work with cannot acquire or analyze data without significant input from an instructor.	Given the appropriate experimental, instrumental or computational context to work with can acquire data with minimal input from an instructor but cannot analyze data without significant input.	Can use prior coursework training to determine appropriate experimental, computational or instrumental method to use for a given situation. Can use prior training to acquire and analyze data using familiar methods with minimal input from an instructor. Most often needs significant help when faced with new experimental, computational or instrumental method.	Can use prior coursework training to determine appropriate experimental, computational or instrumental method to use for a given situation. Can use prior training to acquire and analyze data using familiar methods with minimal input from an instructor. Needs help <50% of the time when faced with new experimental, computational or instrumental method.	Can readily extrapolate prior training into new experimental, computational and instrumental contexts. Can correctly analyze data gleaned via a variety of methods with minimal input from an instructor.

<p>Plan and perform chemical experiments, including running basic synthetic reactions and employing isolation and purification techniques.</p>	<p>Cannot perform chemical experiments without significant input from instructor. Cannot plan an experiment based on prior laboratory experience. Needs to have step-by-step procedure provided for every experiment. Often makes fatal flaws during an experiment that lead to poor and non-reproducible results. Can only do simple mechanically based error analysis.</p>	<p>Can perform a chemical experiment when given the procedure without significant input from an instructor. Cannot plan an experiment based on prior laboratory experience. Needs detailed experimental procedure for the majority of laboratory manipulations even if they have used the same, or similar, technique in a previous experiment. Experimental outcomes are often poor and not reproducible. Can do simple mechanically based error analysis.</p>	<p>Can perform a chemical experiment when given the procedure without significant input from an instructor. Can plan an experiment that is analogous to prior experiments they have done. Needs less detailed instructions to perform each step of an experiment, especially when the techniques/methods are familiar from previous experiments. Experimental outcomes are more often than not good and reproducible. Can identify nonmechanical sources of experimental error.</p>	<p>Can perform and plan new experiments without significant instructor input. Is able to use prior laboratory methods/techniques in new, but analogous, experimental contexts. Is able to follow procedure and make small modifications as needed. Understands chemical basis of most experiments. Gets good, reproducible results the majority of the time. Can perform relatively sophisticated error analysis.</p>	<p>Can perform and plan new experiments without significant instructor input. Can demonstrate a clear understanding of the chemistry investigated in a particular experiment and the underlying conceptual basis of all of the experimental techniques employed. Can readily modify experimental procedures based on the particulars of an experiment. Gets consistently good and reproducible results. Can perform relatively sophisticated error analysis.</p>
<p>Find, organize and present valid scientific information in written and oral form assisted by the use of computer technology.</p>	<p>Needs significant help finding, organizing and presenting scientific information. Cannot, even with repeated instructor input, improve these skills. Makes a multitude of careless errors, particularly in written work. Repeatedly uses scientific information from less reputable web sources rather than use more legitimate disciplinary databases and other library resources. Has an unclear understanding of the science they are presenting.</p>	<p>Can consistently use disciplinary databases and library resources to find information but has poor organizational and writing and oral presentation skills. Organization skills improve with instructor input but writing and/or oral presentational skills are slow to improve. Does not completely understand the science they are presenting.</p>	<p>Can readily get ground-floor scientific job but with reasonable chance for advancement. Has a strong work ethic. Should get accepted into some graduate programs in chemistry related disciplines.</p>	<p>Can readily get ground-floor scientific job but with reasonable chance for advancement. Would be readily accepted into a number of graduate programs in chemistry related disciplines.</p>	<p>After initial training needs minimal instructor input to prepare a well research, organized and written scientific report/paper or oral presentation. Anticipates and can answer the majority of scientific questions related to their presented material. Understands the larger scientific context of what they are presenting.</p>
<p>Successfully pursue further studies or employment in chemistry or interdisciplinary areas involving chemistry.</p>	<p>Is a poor candidate for almost any job related to chemistry even when the job market for scientists is "good". Have poor interpersonal and inadequate scientific skills and a bad work ethic. Would not be appropriate</p>	<p>Can get a low level scientific "tech" job with little probability for advancement. Has decent interpersonal, but only adequate scientific, skills. Is a reliable worker. Would not be an appropriate candidate for graduate level</p>	<p>Can consistently find scientific information using disciplinary databases and library resources. Is able to reasonably organize collected information but has mediocre writing and/or oral presentation skills. Shows marked</p>	<p>Can consistently find scientific information using Disciplinary databases and library resources. Can reasonably organize, write and orally present scientific information. Can generalize instructor input on writing and oral presentation skills</p>	<p>Can readily get ground-floor scientific job but with reasonable chance for advancement. Would get into a number of top-tier graduate programs in chemistry related disciplines.</p>

	candidate for graduate level work.	work.	improvement with instructor input on a particular project, but cannot translate input into new contexts. Can answer some scientific questions that are directly related to their presented material.	into new contexts. Can answer the majority of scientific questions that are directly related to their presented material.	
Successfully pursue further studies or employment in chemistry or interdisciplinary areas involving chemistry.	Is a poor candidate for almost any job related to chemistry even when the job market for scientists is "good". Have poor interpersonal and inadequate scientific skills and a bad work ethic. Would not be appropriate candidate for graduate level work.	Can get a low level scientific "tech" job with little probability for advancement. Has decent interpersonal, but only adequate scientific, skills. Is a reliable worker. Would not be an appropriate candidate for graduate level work.	Can consistently find scientific information using disciplinary databases and library resources. Is able to reasonably organize collected information but has mediocre writing and/or oral presentation skills. Shows marked improvement with instructor input on a particular project, but cannot translate input into new contexts. Can answer some scientific questions that are directly related to their presented material.	Can consistently find scientific information using disciplinary databases and library resources. Can reasonably organize, write and orally present scientific information. Can generalize instructor input on writing and oral presentation skills into new contexts. Can answer the majority of scientific questions that are directly related to their presented material.	Can readily get ground-floor scientific job but with reasonable chance for advancement. Would get into a number of top-tier graduate programs in chemistry related disciplines.