BASIC PROGRAM INFORMATION

Program Review is about documenting the discussions and plans you have for improving student success in your program and sharing that information with the college community. It is also about linking your plans to decisions about resource allocations. With that in mind, please answer the following questions.

Program/Department Name: Chemistry

Division Name: PSME

Please list all team members who participated in this Program Review:

Name	Department	Position
Kathleen Armstrong	Chemistry	Instructor
Richard Daley	Chemistry	Instructor
Mary Holland	Chemistry	Instructor
Londa Larson	Chemistry	Instructor
Sandhya Rao	Chemistry	Instructor
Rosa Nguyen	Chemistry	Instructor
Amanda Pitts	Chemistry	Instructor

Number of Full Time Faculty: 7 **Number of Part Time Faculty:** 16

Please list all existing Classified positions: *Example: Administrative Assistant I*

Anna Wu - Chemistry Lab Technician
Sherman Lee - Chemistry Lab Technician

SECTION 1: PROGRAM REFLECTION

1A. Program Update: Based on the program review data, please tell us how your program did last year. We are particularly interested in your proudest moments or achievements related to student success and outcomes.

The Chemistry program at Foothill College is robust, and aims to equip students with the knowledge and skills needed for success in future coursework. Our students are primarily transfer students, and polls given in 12C (the terminal course for many) show that those completing our program are transferring at a very high rate (>90%). Our laboratories are well equipped and provide students with hands-on experience with instrumentation and data analysis. Students report their appreciation for these experiences and value the laboratory skills that they demonstrate independently upon completion of the program.
In 2015-16, overall student Success rates are unchanged from last year at 66%. Enrollment in Chemistry is also mostly unchanged (up 1%) from the year prior.

Looking further back in time, enrollment of targeted ethnic groups has increased over recent years, increasing by nearly 23% since 2012-13, while untargeted enrollment has dropped by 8%. During this same time frame, success rates have fallen slightly (-2%) overall, with targeted groups accounting for much of the drop (their success rate currently stands at 51% (-3% from 2012-15 average). Given Foothill College's institutional standard of 55%, these numbers highlight the challenge that exists in identifying and addressing the substantial obstacles that persist for these targeted students.

With Equity a central focus of many discussions both at department and college levels, Chemistry faculty are working hard to actively address the challenges of this changing demographic. Efforts aimed at decreasing the achievement gap and increasing success rates overall include the following: (1) fostering an inclusive classroom dynamic, (2) early assessment and intervention with at risk students, (3) encouraging active group participation among differing student populations and (4) increasing efforts to connect students with support resources at the department and college level.
Foothill's Chemistry department is committed to maintaining high standards of scholarship because we know that these standards are required for our learning outcomes to be achieved. Each of us can recount stories of students who, upon graduation, report back their appreciation for the knowledge and skills they gained while at Foothill. Our goal is not to merely impart content knowledge, but to encourage critical thinking and to build skill in analytic reasoning and problem solving. These learning outcomes are not easily achieved. They require repeated exposure and consistency in approach to teaching and learning. Many students have been trained to learn only through memorization or algorithms. These students may initially struggle with the inquiry approach that exists in our Chemistry classes. We believe that we can improve the success rates of our students, but we are firm in our conviction that we must do so without lowering standards.
The Chemistry department has fostered a high level of student engagement. Ours is the only Community College in the Bay Area that has an active Student Affiliate club of the American Chemical Society. The student-led club is supported by two of our Chemistry faculty along with one of our Chemistry laboratory Technicians. In addition to the Chemistry club, many of our students become engaged in Summer Internships. Chemistry faculty are active in promoting these internship opportunities. Chemistry faculty are leading the NSF S-STEM scholarship, which includes mentoring and additional support services in addition to financial support for disadvantaged STEM majors. This scholarship program may in time serve as a model for future efforts to enhance learning for all of our students.

Operationally, the chemistry program is struggling because full-time faculty have committed extra time to fulfilling administrative roles for the department without adequate compensation or release time. These duties include course scheduling, course coordination, hiring of adjunct faculty, and coordination of department activities such as meetings and program reviews. Historically speaking, the administrative demands within the department have increased over the last several years: more in-depth program reviews and the oversight of SLO activities are now required, the chemistry program has grown substantially, and so there is now more time required for scheduling and hiring of adjunct faculty. Currently, faculty who take on these roles receive a stipend. Given the substantial time commitment required, the faculty member's time to focus on course-related activities and pedagogical improvements is negatively impacted. The current stipend does not adequately cover the time spent on these additional duties. Ideally, a faculty member who takes on administrative duties should receive adequate release time to do so, thus enabling them to have sufficient time to act as effective administrators without impacting their effectiveness as classroom instructors. In addition to the coordinator role, the growth of our department and the increasing demands from administration regarding SLO implementation, means that all FT chemistry faculty are now spending more time with mentoring, training and SLO coordination than ever before. These increasing demands place a strain on our time, making it increasingly difficult to participate in college-wide committees or to engage in professional development activities. Our primary commitment is to our students, and these additional duties, while important to the successful operation of our program, are placing considerable strain on the time we have left to devote to our students directly.

We are in the process this year of hiring an additional full-time faculty. This hire is a much-needed replacement for a position vacated when one faculty member moved into an administrative position.

Even with this hire, more than 50% of our courses will be taught by adjuncts. Our past growth in enrollment significantly outpaced our full-time faculty growth. This negatively impacts course consistency and our ability as a department to move forward with curriculum/program development.

1B. Program Improvement: What areas or activities are you working on this year to improve your program? Please respond to any feedback from the supervising administrator from last year's program review.

Introducing Math Workshops/ Short courses/ Online teaching Modules

Chief among reasons identified for low performance in Chemistry is a weakness in fundamental Mathematics. Low-income students have been shown by the American Educational Research Association to receive weaker math curricula (AERA, 2015). Their report showed that this curriculum difference is largely responsible for the achievement gap nationally. The achievement gap starts early in the course of a student's academic career and continues as they enter their mathematics courses at Foothill College. Weaknesses that began in early education and thought to have been resolved can again reveal themselves in later coursework as the level of analytic thinking increases.

Despite the Math prerequisites in place, students are sometimes able to learn how to solve familiar problems and thereby pass their prerequisite Math class without having gained an understanding of the structure and logic of the Mathematics they have applied. Chemistry faculty would like to create new short courses or redress the existing STEM center workshops to address the weakness in mathematics that persists despite our current prerequisites. One option would involve the creation of short (two week) booster workshops that are taught by Chemistry faculty and that align with our courses. A second option would be to design a process that would formalize faculty engagement in the workshops held at the STEM center. One of our faculty is working on a third option as part of her PDL, which would involve creating a series of teaching modules that could be delivered online. These modules would be linked to a series of assessments of readiness/ mastery of essential prerequisite skills. Central to this approach is an integration of these modules with the chemistry courses themselves. Our hope is that this approach would improve equity by uniformly benefitting all students.

Maintaining Instrumentation and Software

The strength of Foothill's Chemistry program lies in the laboratory experiences we provide our students. Only through their laboratory work can students explore the power and ubiquitous nature of Chemistry. In order for students to test what they have been told in their reading and/or lectures, they must gather data using equipment and instrumentation that costs money to purchase and maintain. When one or more of our instruments fails and requires repair or replacement, faculty are left scrambling to try to address the problem in order to minimize impact on our students. The Chemistry program requires reliable funding for the maintenance of its expensive equipment. The integrity of our program and our articulation with transfer institutions is placed at risk whenever an instrument is put out of service for any significant length of time. We are requesting an annual contract for the maintenance of our GC-MS, a contingency fund for replacement of our Infrared Spectrometer and Gas Chromatograph, and a stipend for faculty who must find time during breaks and on weekends to work on our instrumentation.

We currently have 66-75% of our Organic Chemistry courses taught by part-time faculty. These instructors must be given access to chemical drawing software, because communication of Organic Chemistry requires chemical structure drawing. This "CHEMDRAW" software requires annual renewal, but each year it must be requested anew, interrupting its access. Faculty rely heavily on its use to not only draw complex chemical structures for communication with students, but also to create instructional materials in the study of Nuclear Magnetic Resonance Spectroscopy.

Updating and Purchasing New Equipment

This year we are requesting to purchase a classroom video spectrometer and to replace our “coffee cup” calorimeters. The video spectrometer will enable instructors and students to easily view emission spectra together. The instrument comes with software that allows data to be digitally recorded and analyzed. This purchase will modernize our existing emission spectroscopy experiment. Our existing coffee cup calorimeters introduce considerable error to the measurements they are meant for, and can be affordably replaced with solution calorimeters that would increase accuracy.

In addition, Honors courses for CHEM 1A, CHEM 1B, CHEM 12AL, CHEM 12BL and CHEM 12CL have all recently been approved for UC articulation and the sequences will be taught for the first time (pending State approval) starting Fall of 2017. These courses require new chemicals and new instrumentation. Ultraviolet Spectrometers are necessary for students to carry out research-level quantitative kinetic studies that reproduce results published in the Chemical literature. Rotary evaporators will enable students to minimize the release of noxious vapors into the hoods and environment. Last year we were granted some funds to purchase some new equipment for the honors labs, but the funds were insufficient to purchase the number needed to run the lab efficiently. We are therefore requesting funds for a second Rota-Vap (for noxious volatile organic solvent removal) and two additional UV-Vis spectrometers (so that 4 students will be assigned to each instrument, allowing each student to gain skill with the instrument during a 2-3 hour lab. We are also renewing last year's unfunded request for a "bomb calorimeter", to be used in the honors general chemistry sequence. A bomb calorimeter is an instrument that allows combustion of samples in an isolated steel container in order to accurately determine the energy content of the sample (For example, the caloric content of food or the inherent energy content of a particular molecule.).

Curriculum Development in Existing Courses

One curricular improvement that Chemistry faculty would like to pursue is to introduce our students to Computational Chemistry. Computational Chemistry enables students to apply mathematical models that are built upon the thermodynamic and chemical laws that are often most illusive for students. It enables students to “see” molecular structure and to understand how the concepts learned in lecture came to be. The introduction of molecular modeling to our curriculum would represent a substantial improvement that could potentially serve students across all STEM disciplines. The addition of computational chemistry to our curriculum will require us to purchase some Molecular Modeling software.

An additional change planned to the Chemistry curriculum includes reorganizing the Chemistry 1A curriculum to follow an “Atoms First” approach. This approach is based on the core concept that the behavior of matter is determined by the properties of molecules and atoms. In an Atoms First approach, atomic structure, Lewis Structures, bonding and molecular structure are covered early in the quarter, preceding nomenclature, reactivity, stoichiometry, and thermochemistry. This represents a significant change from our existing, traditional approach. In addition to reorganizing the topic order for lecture, this change will necessitate a review and reorganization of the lab curriculum as well, so that it will be in line with the new approach. We are excited about this change, and hopeful that this “Atoms First” pedagogical approach will help students better understand the topics that follow, leading to greater mastery of our learning outcomes and higher success rates.

Improving Pedagogical Discussion

Members of the Chemistry department are fortunate to maintain a strong collegiality. We have increased the frequency of our meetings in an effort to better coordinate the numerous shared duties of

our department, but we struggle to find time for meaningful exchange on pedagogy. In an effort to address our shared goals for greater success in meeting our course and program learning outcomes, we would like support for creating a culture that will strengthen us as a whole rather than merely as individual instructors. Mentoring of part-time faculty, facilitation of full-time faculty discussion, and time for substantive SLO discussion are all currently unfunded activities that will not receive the attention they deserve without support.

1C. Measures of Success: What data or information will you use to measure your success (e.g. student success rates, changes in student or program learning outcomes)?

Our success as a Department can be measured using both qualitative and quantitative measures. We experience pride when our alumni return to thank us for the confidence our courses gave them in their upper division coursework, when we watch our students exhibit their skills during group presentations, and when chemistry departments in the area begin to accept increasing numbers of our students. Quantitatively, we look to our success rates, our retention rates, and perhaps most importantly, we look to our course and program learning outcome assessments. We believe this tool formalizes the process of critical evaluation of our existing program and provides us with data to substantiate our conclusions. Success rates give us an important measure of the percentage of students that make it though the many challenges presented to them in our courses, but on their own, they don't tell us how well the exiting students have achieved the learning outcomes they need. We know that in theory, students who pass our courses are achieving the learning outcomes we have identified for them, but that may or may not be true, which is why it is important for us to continually redress our pedagogy and assessment tools. We are hopeful that by developing strategies to address pedagogy meant to improve the success in meeting our learning outcomes, we will be able to reach a broader audience and improve our success rates as a whole.

1D. EMP Goal: The 2015-2020 Educational Master Plan (EMP) includes the following goal:
"Create a culture of equity that promotes student success, particularly for underserved students."

Based on the program review data, tell us some of the things your program will be doing this year to support this goal. You will be asked to report on any accomplishments on your next comprehensive program review.

As mentioned above, Chemistry courses have seen an increase in the proportion of students from targeted groups. This is a promising development, but it clearly brings with it new challenges. It is promising because it suggests an improvement in recruitment and accessibility. Our programs carry the potential to forge pathways for these students in directions that had been inaccessible to them in the past. It is challenging because the deficiencies in educational background that many targeted students struggle with are not easy to identify and overcome. Ineffective approaches to teaching and learning that emphasize an algorithmic approach can lead to persistent deficiencies in prerequisite problem solving and analytic reasoning. We believe that through application of flexible and considered strategies, we will be able to reach these students and improve our success rates. In addition to focusing on the strategies to address success rates in general discussed above, the Chemistry department is looking for new ways to attract and retain more students from disadvantaged backgrounds. Two members of our Chemistry department have been engaged in a project to test classroom strategies aimed at narrowing the achievement gap. Their findings will serve as a model for future efforts to address this intractable problem. Their work is nearing completion, and will be presented at a Chemistry meeting in the coming year.

SECTION 2: PROGRAM OBJECTIVES & RESOURCE REQUESTS

2A. New Program Objectives: Please list any new objectives (do not list your resource requests).

Program Objective	Implementation Timeline	Progress Measures
Example: Offer 2 New Courses to Meet Demand	*Winter 2016 Term*	*Course Enrollment*
1. Curriculum Development: Create workshops aimed at redressing mathematical concepts key to each Chemistry course (30A, 25, 1A, 1B, 1C)	Ongoing-Annual	Student performance/success rates
2. Curriculum Development: Introduce students to Computational Chemistry	Fall 2017	SLO target met addressing improved understanding of theoretical foundations/structure-reactivity relationship
3. Curriculum Development: Support implementation of honors courses	Purchases Spring 2017; roll out Fall 2017	
4. Improve reliability of Instrumentation for student use	Ongoing- Annual; Maintenance Contract renewed annually; funding for equipment replacement	Continued articulation with UC/CSU
5. Ensure faculty have the tools to communicate the language of Chemistry to their students	Ongoing-Annual	SLO targets met
6. Bring % of classes taught by full-time faculty closer to compliance (currently at 37%)	Fall 2017	Hire 1 full time faculty
7. Coordinator position formally reinstated to ensure adequate attention to essential administrative departmental needs	Ongoing-Annual	One faculty member assigned to the position
8. Unify faculty and encourage collaboration with a faculty retreat		
9. Support part-time faculty and improve course-wide consistency	Ongoing- quarterly	Improved success rates; SLO targets
10. Improve/update spectroscopic capabilities in lab.	Fall 2017	New equipment in house
11. Improve thermodynamic experiment capabilities	Fall 2017	New equipment in house

2B. Resource Requests: Using the table below, summarize your program's unfunded resource requests. Refer to the Operations Planning Committee (OPC) website for current guiding principles, rubrics and resource allocation information.

Resource Request	$	Program Objective (Section 2A)	Type of Resource Request			
			Full-Time Faculty/Staff Position	One-Time B-Budget Augmentation	Ongoing B-Budget Augmentation	Facilities and Equipment
Maintenance Contract for GCMS Contingency Funds for Critical Instrumentation	6000 	#4 above #4 above	☐	☐	☒	☐
2 UV-Vis portable spectrometers RSpec Classroom Video Spectrometer Bomb Calorimeter 15 Copper Calorimeter Sets Ice maker	4000 450 10,000 350 3000	#10 above #10 above #11 above #11 above #4 above	☐	☐	☐	☒
1 Rotavap	3200	#3 above	☐	☐	☐	☒
1 full time faculty		#6 above	☒	☐	☐	☐
Release time or Compensation for Instrument Maintenance/ Troubleshooting/ Training Release time or Compensation for SLO Course Coordination/ Mentoring PT Faculty	3000 ($50/h x 20 h/quarter) 7500 ($50/hr x 50 h/quarter	#4 above #9 above	☐	☐	☒	☐
Release time for Coordinator Position		#7 above	☐	☐	☐	☐
FT faculty Retreat		#8 above	☐	☒	☐	☐

Replace broken Spectroscopy Accessories: GC Syringes, NMR tubes, IR salt plates	1000	#4 above	☐	☐	☐	☒
Chem Draw		#5	☐	☐	☒	☐
Spartan Wavefunction Molecular Modeling Software	7500	#2, #5	☐	☒	☐	☐

2C. Unbudgeted Reassigned Time: Please list and provide rationale for requested reassign time.

Permanent Chemistry Chair/ Coordinator position (see section 1A above)

SECTION 3: LEARNING OUTCOMES ASSESSMENT SUMMARY

3A. Attach 2015-2016 Course-Level Outcomes: Four Column Report for CL-SLO Assessment from TracDat. Please contact the Office of Instruction to assist you with this step if needed.

3B. Attach 2015-2016 Program-Level Outcomes: Four Column Report for PL-SLO Assessment from TracDat. Please contact the Office of Instruction to assist you with this step if needed.

SECTION 4: FEEDBACK AND FOLLOW-UP

This section is for the Dean/Supervising Administrator to provide feedback.

4A. Strengths and successes of the program as evidenced by the data and analysis:

The Chemistry department is a cordial and friendly department that work well together. For a department of 7 full time faculty plus part time faculty, they cover about 120 chemistry sections per year. The full time faculty help with mentoring and training for both classroom pedogagical methodologies and machine/equipment usage.

The chemistry faculty are also highly involved in many activities out of the classroom. This past year, they have been involved in curriculum development, Faculty Teaching and Learning Academy, and National Science Foundation STEM scholarship to name a few. The honors chemistry courses have recently been approved and should help with enrollment.

They also continue to keep their labs current with software and equipment usage. Continual training and upkeep of the equipments are needed and the department does a wonderful job at this, despite limited staff support.

4B. Areas of concern, if any:

1. Success rates for the last 4 years have been declining (unchanged from 2014-15 to 2015-16), dropping from 71% in 2012-13 to 66% in 2015-16. This trend is also seen in the targeted group, from

59% in 2012-13 to 51% in 2015-16.
2. Enrollment has maintain relatively unchanged for the last four years: 3191, 3201, 3144, 3176 while the college enrollment has increased: 124,539; 126,662; 129,280; 130,936
3. Chemistry courses are taught more by part time instructors (70.8%) than full time instructors (26.7%) in 2015-16
4. Safety training in the labs, training of equipments, and training for hazard materials can be improved.

4C. Recommendations for improvement:

Some recommendations are:
1. Faculty are looking into creating activities to help with student success. I would suggest that they also look into active learning as they create these activities. For example, here are some resources found on the web:
http://chem.lapeer.org/Alice/Index.html
https://www.nsf.gov/awardsearch/showAward?AWD_ID=0510543
https://www.nsf.gov/awardsearch/showAward?AWD_ID=1504989
http://community.asdlib.org/activelearningmaterials/
2. Courses like the Chemistry of Cooking are not getting the high enrollment probably due to proper communication. Now that we have a support staff for dual enrollment, I believe that this course can be very attractive to high school students but many of the local high schools do not know about the course. Maybe a pamphlet or flyer about the course can be distributed to local high school. Similarly, one can also be done for the organic chemistry courses which appear to be on the decline (probably due to the loss of the full time organic chemistry faculty who moved into administration)
3. Hire another full time chemistry instructor. This should help with the part-time to full-time ratio
4. Chemistry coordinator (probably with release time from the faculty rank) would be able to coordinate these safety trainings

4D. Recommended Next Steps:

☒ Proceed as Planned on Program Review Schedule
☐ Further Review / Out-of-Cycle In-Depth Review

Upon completion of Section 4, the Program Review document should be returned to department faculty/staff for review, then submitted to the Office of Instruction and Institutional Research for public posting. Please refer to the Program Review timeline.

Unit Course Assessment Report - Four Column

Foothill College

Department - Chemistry (CHEM)

Mission Statement: The mission of the Chemistry Department is to provide our diverse student body with equitable access to undergraduate education founded on a rigorous, applied treatment of chemistry fundamentals coupled with application of modern analytical techniques to prepare students for transfer to a four-year university or professional health program.

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Department - Chemistry (CHEM) - CHEM 100 - CHEMISTRY STUDENT ASSISTANCE - Numerical Problems - The students will be able to use analysis to set up and solve numerical problems. (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 100 - CHEMISTRY STUDENT ASSISTANCE - Skill Development - Student will spend the appropriate amount of time in PSME Center working on skills. (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 100X - CHEMISTRY STUDENT ASSISTANCE - Numerical Problems - The students will be able to use analysis to set up and solve numerical problems. (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 100X - CHEMISTRY STUDENT ASSISTANCE - Skill Development - Student will spend the appropriate amount of time in PSME Center working on skills. (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:**			

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Active			
Department - Chemistry (CHEM) - CHEM 100Y - CHEMISTRY STUDENT ASSISTANCE - Numerical Problems - The students will be able to use analysis to set up and solve numerical problems. (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 100Y - CHEMISTRY STUDENT ASSISTANCE - Skill Development - Student will spend the appropriate amount of time in PSME Center working on skills. (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 11A - ORGANIC CHEMISTRY FOR LIFE SCIENCE MAJORS - Organic Molecule Structure - Identify structural features of an organic compound that influence its reactivity (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Academic Year **Start Date:** 07/10/2016 **End Date:** 07/10/2017 **Course-Level SLO Status:** Active	**Assessment Method:** Rank the stability of six organic compounds. Assign equal credit for each successive pair of compounds (five relative comparisons for six compounds) **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 78% average class score **Assessment Method:** Rank the stability of five different cationic intermediates. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Over 70% of the class can correctly rank at least four out of the five intermediates correctly. **Assessment Method:** Embedded question on Final exam:		

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
	Ask students to rank the reactivity of several organic compounds with reference to a specific reaction (ie acid-base or Nucleophilic Substitution) Assign equal credit to each successive ranking comparison. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 80% overall score		
Department - Chemistry (CHEM) - CHEM 11A - ORGANIC CHEMISTRY FOR LIFE SCIENCE MAJORS - Reactivity - Predict the products of reactions involving organic compounds (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Academic Year **Start Date:** 09/26/2016 **End Date:** 09/24/2017 **Course-Level SLO Status:** Active	**Assessment Method:** Embedded M/C question on Final Exam in which a product is shown and the student is asked to CIRCLE ALL reactions or reaction sequences that would produce that product in high yield. If the question is worth 5 points, then the correct circled response is worth 5 points with 1 point deduction for any incorrect answers. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 80% correct		
	Assessment Method: Embedded series of open-ended questions on final exam: A series of complex organic reactions where students must predict the product, taking into account stereochemistry and other considerations. Each question is worth 5 points with 3 points for answers with incorrect stereochemistry and 2 points for answers with incorrect regiochemistry **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 80% (4/5 points)		
Department - Chemistry (CHEM) - CHEM 11A - ORGANIC CHEMISTRY FOR LIFE	**Assessment Method:** Embedded ranking question on final exam:		

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
SCIENCE MAJORS - Equilibrium - Utilizing theories that affect product stability, predict the relative acidity and/or relative reactivity of organic compounds with similar molecular structure and/or functional groups. (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Academic Year **Start Date:** 09/26/2016 **End Date:** 12/13/2017 **Course-Level SLO Status:** Active	For a series of five organic compounds, rank their relative acidity in decreasing order. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 80% correct		
	Assessment Method: On the Final exam, rank the Heats of combustion of 2-5 different structural isomers **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** If question is to compare just 2 isomers: 100%; If question is to compare 5 isomers: 80%		
Department - Chemistry (CHEM) - CHEM 11B - ORGANIC CHEMISTRY FOR LIFE SCIENCE MAJORS - Reactivity - Predict the products of reactions involving organic compounds (Created By Department - Chemistry (CHEM)) **Start Date:** 09/26/2011 **End Date:** 09/24/2012 **Course-Level SLO Status:** Active	**Assessment Method:** Embedded series of open-ended questions on final exam: A series of complex organic reactions where students must predict the product, taking into account stereochemistry and other considerations. Each question is worth 5 points with 3 points for answers with incorrect stereochemistry and 2 points for answers with incorrect regiochemistry **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 80%		
	Assessment Method: Embedded M/C question on Final Exam in which a product is shown and the student is asked to CIRCLE ALL reactions or reaction sequences that would produce that product in high yield. If the question is worth 5 points, then the correct circled response is worth 5 points with 1 point deduction for any incorrect answers. **Assessment Method Type:**		

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
	Exam - Course Test/Quiz **Target for Success:** 80%		
Department - Chemistry (CHEM) - CHEM 11B - ORGANIC CHEMISTRY FOR LIFE SCIENCE MAJORS - Equilibrium and Reactivity - Utilizing theories that affect product stability, predict the relative acidity/reactivity of organic compounds with similar molecular structure and/or functional groups. (Created By Department - Chemistry (CHEM)) **Start Date:** 09/26/2011 **End Date:** 12/13/2011 **Course-Level SLO Status:** Active	**Assessment Method:** Embedded question on Final exam: Ask students to rank the reactivity of several organic compounds with reference to a specific reaction (ie acid-base or Nucleophilic Substitution) Assign equal credit to each successive ranking comparison. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 80% overall score		
	Assessment Method: Embedded ranking question on final exam: For a series of five organic compounds, rank their relative acidity in decreasing order. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 80%		
Department - Chemistry (CHEM) - CHEM 11B - ORGANIC CHEMISTRY FOR LIFE SCIENCE MAJORS - Organic Molecule Structure_1 - Identify structural features of an organic compound that influence its reactivity (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Academic Year **Start Date:** 07/10/2016 **End Date:** 07/10/2017 **Course-Level SLO Status:** Active	**Assessment Method:** On the Final exam, circle the reaction that is faster (based on the stability of the carbocationic intermediate). (2-3 points) Explain why (4-5 points) **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 75% of points accrued (eg 3/3 points for correct answer and another 3/5 points for explanation)		

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Department - Chemistry (CHEM) - CHEM 11C - ORGANIC CHEMISTRY FOR LIFE SCIENCE MAJORS - Reactivity - Predict the products of reactions involving organic compounds (Created By Department - Chemistry (CHEM)) **Start Date:** 09/26/2011 **End Date:** 09/24/2012 **Course-Level SLO Status:** Active	**Assessment Method:** Embedded M/C question on Final Exam in which a product is shown and the student is asked to CIRCLE ALL reactions or reaction sequences that would produce that product in high yield. If the question is worth 5 points, then the correct circled response is worth 5 points with 1 point deduction for any incorrect answers. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 80%		
	Assessment Method: Embedded series of open-ended questions on final exam: A series of complex organic reactions where students must predict the product, taking into account stereochemistry and other considerations. Each question is worth 5 points with 3 points for answers with incorrect stereochemistry and 2 points for answers with incorrect regiochemistry **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 70%		
Department - Chemistry (CHEM) - CHEM 11C - ORGANIC CHEMISTRY FOR LIFE SCIENCE MAJORS - Equilibrium and Reactivity - Utilizing theories that affect product stability, predict the relative acidity/reactivity of organic compounds with similar molecular structure and/or functional groups. (Created By Department - Chemistry (CHEM)) **Start Date:** 09/26/2011 **End Date:** 12/13/2011 **Course-Level SLO Status:**	**Assessment Method:** Embedded ranking question on final exam: For a series of five organic compounds, match pKa's to the compound. Each correct assignment is equally weighted. Partial credit (up to 1/2 of points) may be awarded for pKa's that are close but incorrectly assigned) **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 50% of student perfectly rank all 5 compounds		

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Active			
Department - Chemistry (CHEM) - CHEM 11C - ORGANIC CHEMISTRY FOR LIFE SCIENCE MAJORS - Organic Molecule Structure_1 - Identify structural features of an organic compound that influence its reactivity (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Academic Year **Start Date:** 07/10/2016 **End Date:** 07/10/2017 **Course-Level SLO Status:** Active	**Assessment Method:** On the Final exam, circle the reaction that is faster (based on the stability of the carbocationic, anionic or radical intermediate). (2-3 points) Explain why (4-5 points) **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 6/8 points = 75% success		
Department - Chemistry (CHEM) - CHEM 12A - ORGANIC CHEMISTRY - Relative Reactivity - Utilizing theories that explain thermodynamic and/or kinetic stability, predict the relative reactivity of organic compounds with similar molecular structure and/or functional groups. (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Academic Year **Start Date:** 09/26/2011 **End Date:** 12/13/2011 **Course-Level SLO Status:** Active	**Assessment Method:** Embedded ranking question on final exam: For a series of five organic compounds, rank their relative acidity in decreasing order. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 50% of student perfectly rank all 5 compounds **Related Documents:** Fall 2011 - Chem 12A SLO 01	12/11/2013 - This question was worth 16 points (4 relative rankings for 5 compounds). Of 38 students, 7 students (18%) received full credit (16/16); 14 students (39%) missed one ranking; 10 students (26%) missed two; 5 students (13%) missed three and 2 students (5%) missed all of them. Average score was 64% **Result:** Target Not Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** None **Resource Request:** None **GE/IL-SLO Reflection:** This learning outcome addresses the Critical thinking Institutional learning outcome. The 64% average reveals that students are less capable in the synthesis and evaluation of complex information than we would hope.	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		GE/IL-SLO Reflection: This learning outcome addresses the Critical thinking Institutional learning outcome. The 64% average reveals that students are less capable in the synthesis and evaluation of complex information than we would hope.	
		01/27/2012 - From a class size of 48 students, 29% ranked all five compounds correctly. Another 27% ranked four out of the five correct. This 27% portion all made the same mistake which is common for this type of question -- all improperly ranked the hydronium ion as not being the most acidic compound. Another 29% ranked less than half of the compounds correctly, and 15% missed the question completely. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012 **Resource Request:** Develop a workbook with a myriad of acid/base practice problems.	01/27/2012 - The results of this CLSLO were expected. After assessing students with this question for multiple years, it is common to have at least 50% of the class either perfectly rank the compounds or just miss one - the hydronium ion. This points out the misconception students hold that an acidic group either bonded to a carbon or a hydrogen will have its acidity affected adversely. In fact, this is not the case and greater emphasis will need to be made of this fact. Deeper analysis of pKa tables found in chemistry and biochemistry may assist in dispelling the misconception.
Department - Chemistry (CHEM) - CHEM 12A - ORGANIC CHEMISTRY - Net Reactions - Apply an understanding of functional group reactivity to predict the product of an organic reaction. (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Academic Year **Start Date:** 09/26/2011 **End Date:** 09/24/2012	**Assessment Method:** Embedded series of open-ended questions on final exam: A series of 7 complex organic reactions where students must predict the product, taking into account stereochemistry and other considerations. Each question is worth 5 points (total of 35 points), with simple mistakes (usually with stereochemistry) results in only 3 points being awarded. Evidence of no understanding of the reaction or mechanism resulted in 0 points being awarded.	12/11/2013 - The class average for the "predict the product" portion of the Final exam in F13 was 80% (31.9 out of 40 possible points). Scores ranged from a low of 11(27.5%) to a high of 40 (100%). The overall exam average was 68%, which demonstrates the lower level of difficulty for these kinds of problems. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Course-Level SLO Status: Active	**Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 70% overall average (24.5 points out of 35 points). **Related Documents:** Fall 2011 - Chem 12A SLO 02	**Resource Request:** none **Resource Request:** none **Resource Request:** none **GE/IL-SLO Reflection:** This result demonstrates a competency in synthesis and evaluation of information, which is a key component to the institutional learning outcome of COMPUTATION **GE/IL-SLO Reflection:** This result demonstrates a competency in synthesis and evaluation of information, which is a key component to the institutional learning outcome of COMPUTATION **GE/IL-SLO Reflection:** This result demonstrates a competency in synthesis and evaluation of information, which is a key component to the institutional learning outcome of COMPUTATION	
		01/11/2013 - Out of a class of 52 students, an average score of 26.13 points (74.7%) was achieved with a standard deviation of 8.2. Considering the complexity of reactions examined, this result reflects an overall satisfactory understanding of reaction mechanisms, stereochemistry and reactivity **Result:** Target Met **Year This Assessment Occurred:** 2012-2013	01/11/2013 - Additional exercises and worksheets with increasingly difficult reactions will be developed in order to assist students in exam preparation and better understanding of reaction mechanisms.
		01/27/2012 - For a class of 48 students, the average score was 24.6/35 points (70.3%), with the median score being 27 points. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012	01/27/2012 - A 70% average on this type of question definitely exhibits that a majority of the students have a better than average understanding of reaction mechanisms, stereochemistry and reactivity. With a median score of 27 points, and many other students scoring in the 30-point range, students are

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
			achieving the goal set forth. This concept will be repeated in later quarters of organic chemistry, solidifying most weak students' understanding.
	Assessment Method: Embedded M/C question on Final Exam **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 85%		
	Assessment Method: Embedded question on Final exam: Ask students to rank the reactivity of several organic compounds with reference to a specific reaction (ie acid-base or Nucleophilic Substitution) Assign equal credit to each successive ranking comparison. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 80% overall score	01/10/2012 - 67% overall score (38 responses) **Result:** Target Not Met **Year This Assessment Occurred:** 2011-2012 **Resource Request:** none **GE/IL-SLO Reflection:** This question incorporated a number of structure/reactivity relationships (inductive effects, resonance, charge type). Students were required to recognize which was most important and their poor responses reflects a weak assimilation of the disparate ideas.	
Department - Chemistry (CHEM) - CHEM 12A - ORGANIC CHEMISTRY - Organic Molecule Structure_1 - Understand how various structural features of an organic compound may influence its reactivity (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Academic Year **Start Date:** 07/10/2016	**Assessment Method:** Rank the stability of six organic compounds. Assign equal credit for each successive pair of compounds (five relative comparisons for six compounds) **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 78% average class score		
	Assessment Method: Rank the stability of five different cationic		

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
End Date: 07/10/2017 **Course-Level SLO Status:** Active	intermediates. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Over 70% of the class can correctly rank at least four out of the five intermediates correctly.		
Department - Chemistry (CHEM) - CHEM 12A - ORGANIC CHEMISTRY - Stereochemistry - Evaluate the stereochemistry of an organic compound (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Quarter **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 12AL - ORGANIC CHEMISTRY LABORATORY - Safety in Lab - Safely handle Organic Chemicals (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Quarter **Start Date:** 09/01/2017 **End Date:** 06/30/2018 **Course-Level SLO Status:** Active	**Assessment Method:** Students are required to prepare and present safety precautions to class based on research into MSDS data for any given laboratory experiment **Assessment Method Type:** Class/Lab Project **Target for Success:** Students should score =85% on this assignment		
Department - Chemistry (CHEM) - CHEM 12AL - ORGANIC CHEMISTRY LABORATORY - Technique - Gain skill with common synthetic chemistry techniques (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Academic Year	**Assessment Method:** Successful application of chemical techniques such as extraction, recrystallization, distillation, etc., is evidenced in part by the % yield achieved during a preparative experiment. **Assessment Method Type:** Data		

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Start Date: 09/01/2017 **End Date:** 06/30/2018 **Course-Level SLO Status:** Active	**Target for Success:** Class average for microscale varies depending on experiment, but should be =33% of published yields.		
Department - Chemistry (CHEM) - CHEM 12AL - ORGANIC CHEMISTRY LABORATORY - Data Interpretation - Interpret experimental data through application of theoretical models (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Quarter **Start Date:** 09/01/2017 **End Date:** 06/30/2018 **Course-Level SLO Status:** Active	**Assessment Method:** Post-Laboratory Reports on laboratory investigations require students to extract data relevant to inquiry and to derive conclusions about the extent to which it fits current theoretical models. **Assessment Method Type:** Research Paper **Target for Success:** Students should earn grades =75% on their lab reports		
Department - Chemistry (CHEM) - CHEM 12B - ORGANIC CHEMISTRY - Stereochemical Reaction - Determine the stereochemical outcome of a chemical reaction based on its mechanism. (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active	**Assessment Method:** Multiple Choice question embedded on Final exam Students must identify products formed in a chemical reaction as 2 enantiomers 2 diastereomers 4 stereoisomers a single stereoisomer a single achiral compound **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 80% of students correctly identify stereochemical outcome of reaction		
	Assessment Method: Imbedded multiple choice question on the final exam asking students to determine if an alkene results in a racemic mixture after being subjected to 5 different reagents.	03/26/2014 - 21/49 students received full credit for this question. 18/49 missed just one. This equates to 79.6%. **Result:** Target Met	09/21/2014 - In future assessment method should include the product identification as well. It is clear that some students did not know the correct product structure, but were

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
	Question; Which of the following reactions would result in a racemic mixture when combined with (E)-3-methylpent-2-ene? (Circle ALL that apply). a. catalytic hydrogenation (H2/Pd catalyst) b. epoxidation followed by acid hydrolysis (i. mCPBA; ii. H+, H2O) c. hydroboration (i. BH3, ii. 3 NaOH, 3 H2O2) d. ozonolysis (i. O3, ii. Zn, AcOH) e. dihydroxylation (i. OsO4, ii. NaHSO3, H2O) **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 80% of the class scores either a perfect or chooses 4 out of 5 reactions correctly.	**Year This Assessment Occurred:** 2013-2014 **Resource Request:** none **GE/IL-SLO Reflection:** This assessment required students to synthesize and apply knowledge to solve a problem. Their success in meeting the goal suggests that we are successfully addressing the critical thinking institutional learning outcome. 04/22/2013 - Out of 47 students, 18 students correctly identified all 5 reactions, while 20 students identified 4 out of 5 reactions correctly. This is a success rate of 80.9%. Based on these findings, most students are comfortable and proficient with how reagents can affect the stereochemical outcome of reactions. **Result:** Target Met **Year This Assessment Occurred:** 2012-2013	still able to guess the correct stereochemistry (racemic or not) 04/22/2013 - Including stereochemistry in reaction prediction questions requires students to go beyond memorization and to focus on the mechanism and spatial arrangement of atoms and electrons. Testing (despite how the material is presented in the book) should conform to standards where memorization is limited.
Department - Chemistry (CHEM) - CHEM 12B - ORGANIC CHEMISTRY - Chemical Reaction Outcome - Effectively write an electronic mechanism accounting for the outcome of a chemical reaction. (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active	**Assessment Method:** Final Exam short answer mechanism question : Question should be closely related to the following: "Use curved-arrow formalism to show the mechanism of the following chemical transformation. Show every step in sequence including all proton transfer steps. Include all non-bonded electrons and formal charges." **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Class average of 77% of question points	03/26/2014 - 49 students completed two mechanism questions in W2014. The average score was 25.4/35=73% The high standard deviation (8) for the average reveals that some very low scores influenced the outcome. Low score on this question was 6.5/35.High was 35/35. **Result:** Target Not Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** None **Resource Request:** None	09/21/2014 - In future median should be measured in addition to mean in order to best assess class performance in cases where there are a few scores far outside of mean.

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
	awarded	**GE/IL-SLO Reflection:** Although the class average fell short of target, this assessment addresses the institutional learning outcome of Creative, Critical and Analytical thinking. This assessment shows that most students are successfully reaching this goal. **GE/IL-SLO Reflection:** Although the class average fell short of target, this assessment addresses the institutional learning outcome of Creative, Critical and Analytical thinking. This assessment shows that most students are successfully reaching this goal.	
	Assessment Method: Embedded final exam question; open-ended where the student must provide a detailed, stepwise mechanism to account for the synthesis of BPA from acetone and two equivalents of phenol. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Due to the extreme difficulty of this question, the target for success will be if a student earns at least 50% of the available points (20 points).	04/22/2013 - The average score (out of 20 points) for 47 students was 11.83 (59.2%). Considering the difficult nature of the mechanism question, the target was met and demonstrates above average proficiency in mechanism writing. The median score was 14 points with at least 8 students scoring a perfect (17%). Most students provided answers that included basic mechanism writing skills but not enough to complete the question. **Result:** Target Met **Year This Assessment Occurred:** 2012-2013	04/22/2013 - To avoid encouraging memorization, these open-ended type questions are best at assessing true understanding of electron movement and reactivity. Going forward, more of these higher-order reactions should be included in testing and lecture discussions.
Department - Chemistry (CHEM) - CHEM 12B - ORGANIC CHEMISTRY - Themodynamics and Kinetics - Understand the role thermodynamics and kinetics plays in the outcome of a chemical reaction. (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active	**Assessment Method:** Final exam question addressing Kinetic vs Thermodynamic control in 1,2 vs 1,4 addition to conjugated dienes **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 80% of students correctly answer question	05/06/2012 - 88% of students were able to correctly predict the major product of addition to 1,3-diene. Only 74% of students were able to correctly explain why the thermodynamic and Kinetic products were the same in this particular reaction. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012	05/06/2012 - Students often memorize content-based information without understanding the theoretical scaffolding upon which this information is derived. This deeper understanding must be assessed so that students are encouraged to develop greater analytic reasoning skills.

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		Resource Request: none **GE/IL-SLO Reflection:** This question reveals that short answer questions are far more revealing of the depth of students' understanding than are multiple choice answers alone. While M/C answer addresses acquisition of content- based knowledge, it does not as effectively measure true understanding or require the the same kind of analytic reasoning. M/C question must contain an 'Explain' or other short-answer follow-up component.	
Department - Chemistry (CHEM) - CHEM 12B - ORGANIC CHEMISTRY - Organic Molecule Structure - Identify structural features of an organic compound that influence its reactivity (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Academic Year **Start Date:** 07/10/2016 **End Date:** 07/10/2017 **Course-Level SLO Status:** Active	**Assessment Method:** Rank the stability of six organic compounds. Assign equal credit for each successive pair of compounds (five relative comparisons for six compounds) **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 78% average class score		
	Assessment Method: Rank the stability of five different cationic intermediates. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Over 70% of the class can correctly rank at least four out of the five intermediates correctly.		
Department - Chemistry (CHEM) - CHEM 12BL - ORGANIC CHEMISTRY LABORATORY - Safety in Lab - Safely handle Organic Chemicals (Created By Department - Chemistry (CHEM))			

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Assessment Cycles: End of Quarter **Start Date:** 09/01/2017 **End Date:** 06/30/2018 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 12BL - ORGANIC CHEMISTRY LABORATORY - Technique - Gain skill with common synthetic chemistry techniques (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Academic Year **Start Date:** 09/01/2017 **End Date:** 06/30/2018 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 12BL - ORGANIC CHEMISTRY LABORATORY - Data Interpretation - Interpret experimental data through application of theoretical models (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Quarter **Start Date:** 09/01/2017 **End Date:** 06/30/2018 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 12C - ORGANIC CHEMISTRY - Organic Target Molecules - Design a concise, logical chemical synthesis of an expanded array of	**Assessment Method:** An open-ended question embedded during the final exam that provides the student a complex target molecule, which must be	08/07/2013 - (NOTE: For this year's assessment, the question was out of 26 possible points. A score of 18 points would be considered proficient since 4 points were deducted for each error). For	08/07/2013 - A new, more rigorous textbook is being adopted in Fall 2013 with more difficult synthesis

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
organic target molecules from simple precursors. (Created By Department - Chemistry (CHEM)) **Start Date:** 04/04/2011 **End Date:** 06/24/2011 **Course-Level SLO Status:** Active	synthesized from simple starting material. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Out of 20 possible points, and a 3 point deduction for each error in the student's synthetic scheme, students scoring around 17 points would be considered proficient at synthesis. **Related Documents:** Chemistry 12C - Synthesis 01	a class of 47 students, the average was 20/26 (77%) with a standard deviation of 4.9 points. Ten students scored 100% on this question with 34 students scoring above 18 points. Most errors were minor with only one student scoring in single digits. These results suggest students are comfortable combining reactions from various chapters for use in synthesis questions. **Result:** Target Met **Year This Assessment Occurred:** 2012-2013	questions than the current textbook. These additional problems will help students practice and hopefully solidify critical thinking skills required for this type of problem-solving.
		07/24/2012 - Synthesis required a minimum of five steps. Partial credit was given for strategies that showed knowledge of key transformations and for overall strategy. Points were deducted from sequences which included unnecessary steps. Overall average was 16/20 from 36 students. This represents an 80%average which in turn corresponds to a 'B' letter grade so target may be too high. **Result:** Target Not Met **Year This Assessment Occurred:** 2011-2012 **Resource Request:** None **GE/IL-SLO Reflection:** students demonstrated good memorization of key transformations and some creative construction. a very few students proposed entirely novel approaches. it may be possible to encourage efficient syntheses through point deduction for inefficient approaches. These problems require a strong mastery of the course material as well as strong problem solving/ analytic reasoning skills.This assessment demonstrates critical and creative thinking very well.	09/09/2012 - Additional assessment could include breakdown of strategic missteps, for example, points lost because reagents incomplete (missing) or because of low yielding step(s). In this assessment low yielding steps were most common source of point loss. More examples of common traps may prove useful in class. Average is still most useful since low scores are typically the result of many strategic missteps and can't be characterized further.

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		06/24/2011 - For a class size of 50 students, the average score for the assessed synthesis question (which focused on aromatic and amine chemistry) was 16.54/20.00, while the median score was 20. Over half the students scored 20/20 on this question, with nearly all others scoring above 14 points. Only 4 students scored less than 10 points. **Result:** Target Met **Year This Assessment Occurred:** 2010-2011	10/14/2011 - Synthesis questions are the most difficult and complex in organic chemistry. A majority of the students' schemes demonstrated proficiency in selecting compatible chemical reagents, foresight in building carbon scaffolds, and analysis in functional reactivity. This data demonstrates students have gained skills in organic synthesis and are able to carry these abilities into the workforce.
	Assessment Method: Students are given a series of reactants and products and asked to propose a reaction sequence that will result in the transformation shown in high yield. Four such questions were grouped together on S14 final exam for a total of 40 points. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Partial credit is highly subjective and difficult to award given the limited number of strategies available for these particular syntheses. An average of 75% suggests that the class demonstrates a satisfactory proficiency in solving these challenging problems. **Related Documents:** synthesis problems	09/18/2015 - Two synthesis questions grouped together for a total of 24 points on S15 Final; 32 responses gave a class average of 18/24 = 75%. **Result:** Target Met **Year This Assessment Occurred:** 2014-2015 **Resource Request:** none **Resource Request:** none **GE/IL-SLO Reflection:** This assessment relates to the Institutional Learning Outcome of Creative, Critical and Analytic Thinking. This assessment requires a high order of analytic reasoning by requiring application of knowledge to a novel problem. Success provides evidence that this goal is being reached by graduating students. **GE/IL-SLO Reflection:** This assessment relates to the Institutional Learning Outcome of Creative, Critical and Analytic Thinking. This assessment requires a high order of analytic reasoning by requiring application of knowledge to a	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		novel problem. Success provides evidence that this goal is being reached by graduating students.	
		06/25/2014 - Class average (36 students) for these four questions was 30.6/40 = 76.5%. Median was 32/40 = 80%. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** none **GE/IL-SLO Reflection:** Success with this assessment method requires a high level of synthesis, evaluation and creativity. The class performance reveals that students have successfully reached the Institutional Learning outcome of Creative, Critical and Analytic thinking.	
Department - Chemistry (CHEM) - CHEM 12C - ORGANIC CHEMISTRY - Organic Molecule Structure - Identify structural features of an organic compound that influence its reactivity (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Academic Year **Start Date:** 07/10/2016 **End Date:** 07/10/2017 **Course-Level SLO Status:** Active	**Assessment Method:** Rank the stability of six organic compounds. Assign equal credit for each successive pair of compounds (five relative comparisons for six compounds) **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 78% average class score		
	Assessment Method: Rank the stability of five different cationic intermediates. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Over 70% of the class can correctly rank at least four out of the five intermediates correctly.		

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Department - Chemistry (CHEM) - CHEM 12C - ORGANIC CHEMISTRY - Propose the mechanism of a chemical transformation - Propose the mechanism of a chemical transformation using curved-arrow formalism that is consistent with known kinetic data. (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Academic Year **Start Date:** 06/01/2016 **End Date:** 06/01/2018 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 12CL - ORGANIC CHEMISTRY LABORATORY - Safety in Lab - Safely handle Organic Chemicals (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Quarter **Start Date:** 09/01/2017 **End Date:** 06/30/2018 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 12CL - ORGANIC CHEMISTRY LABORATORY - Technique - Gain skill with common synthetic chemistry techniques (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Academic Year **Start Date:** 09/01/2017			

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
End Date: 06/30/2018 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 12CL - ORGANIC CHEMISTRY LABORATORY - Data Interpretation - Interpret experimental data through application of theoretical models (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Quarter **Start Date:** 09/01/2017 **End Date:** 06/30/2018 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 13AH - HONORS ORGANIC CHEMISTRY LABORATORY - Safety in Lab - Safely handle Organic Chemicals (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Quarter **Start Date:** 09/01/2017 **End Date:** 06/30/2018 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 13AH - HONORS ORGANIC CHEMISTRY LABORATORY - Technique - Gain skill with common synthetic chemistry techniques (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Academic Year **Start Date:**			

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
09/01/2017 **End Date:** 06/30/2018 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 13AH - HONORS ORGANIC CHEMISTRY LABORATORY - Data Interpretation - Interpret experimental data through application of theoretical models (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Quarter **Start Date:** 09/01/2017 **End Date:** 06/30/2018 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 13BH - HONORS ORGANIC CHEMISTRY LABORATORY - Safety in Lab - Safely handle Organic Chemicals (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Quarter **Start Date:** 09/01/2017 **End Date:** 06/30/2018 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 13BH - HONORS ORGANIC CHEMISTRY LABORATORY - Technique - Gain skill with common synthetic chemistry techniques (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Academic Year			

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Start Date: 09/01/2017 **End Date:** 06/30/2018 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 13BH - HONORS ORGANIC CHEMISTRY LABORATORY - Data Interpretation - Interpret experimental data through application of theoretical models (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Quarter **Start Date:** 09/01/2017 **End Date:** 06/30/2018 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 13CH - HONORS ORGANIC CHEMISTRY LABORATORY - Safety in Lab - Safely handle Organic Chemicals (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Quarter **Start Date:** 09/01/2017 **End Date:** 06/30/2018 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 13CH - HONORS ORGANIC CHEMISTRY LABORATORY - Technique - Gain skill with common synthetic chemistry techniques (Created By Department - Chemistry (CHEM))			

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Assessment Cycles: End of Academic Year **Start Date:** 09/01/2017 **End Date:** 06/30/2018 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 13CH - HONORS ORGANIC CHEMISTRY LABORATORY - Data Interpretation - Interpret experimental data through application of theoretical models (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Quarter **Start Date:** 09/01/2017 **End Date:** 06/30/2018 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 13CH - HONORS ORGANIC CHEMISTRY LABORATORY - Experimental Design - Critically evaluate an experimental approach to rationalize the need for each element of an experimental design (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Quarter **Start Date:** 09/01/2017 **End Date:** 06/30/2018 **Course-Level SLO Status:** Active	**Assessment Method:** Students must correctly identify the consequence of a proposed change to the optimal experimental procedure in a short answer exam question **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Students should score =75% on this question		
Department - Chemistry (CHEM) - CHEM 1A - GENERAL CHEMISTRY - Graphing and Data Analysis - A student who successfully	**Assessment Method:** All questions were assessed online through Mastering General Chemistry in Quiz format.	05/05/2012 - 97.1% of the students participated in the assessment with an average score 76.9%.	08/27/2012 - Students had the most difficulty with the question involving

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
masters the material in Chemistry 1A at Foothill College will be able to read and interpret graphs and data. (Created By Department - Chemistry (CHEM)) **Start Date:** 01/09/2012 **End Date:** 06/30/2016 **Course-Level SLO Status:** Active	Three questions were assessed. Two questions involved differentiating between physical and chemical properties/changes using given experimental descriptions/data. One question required students to read and interpret an Enthalpy Diagram. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Average score of 80% with 90% participation.	**Result:** Target Not Met **Year This Assessment Occurred:** 2011-2012 **GE/IL-SLO Reflection:** Students scored highest on the questions involving experimental descriptions compared to diagrams. Increased class time devoted to developing critical thinking as applied to interpreting and understanding graphs and diagrams will improve skills in these areas.	the Enthalpy Diagram. The low resulting average score of 62.5% on this question brought the overall average below the target score. Upon reflection, the diagram used for this question was not covered/discussed in detail during class time. More class time will be devoted to developing an understanding of these types of energy related diagrams.
	Assessment Method: Two MasteringChemistry online HW questions were used to assess students' ability to interpret data. Question #1 had students reason about a set of experimental data to determine whether a physical or chemical change had taken place. Question #2 had students analyze a set of density data and reason about precision and accuracy of the datasets. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** A average score of 80% was targeted with a participation rate of 90%.	10/11/2013 - For question #1: 100% of students (N=67) were able to get the right answer using the number of attempts allotted. The average score was 97.4% For question #2: 100% of students (N=67) were able to get the right answer using the number of attempts allotted. The average score was 96.8% **Result:** Target Met **Year This Assessment Occurred:** 2012-2013	10/11/2013 - This assessment was made using the online HW system very soon after the concepts were covered in class. It would be interesting to see how students retained these concepts over the course of the quarter by assessing the same concepts on the final exam. Then, the performance could be compared to assess retention of the ideas.
	Assessment Method: MasteringChemistry online HW questions were used to assess students' ability to interpret data. Question #1 had students analyze a set of density data and reason about precision and accuracy of the datasets. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** A average score of 80% was targeted.	10/08/2014 - 59 students completed the Item "Measurements: Accuracy and Precision" on the Chapter 1 Online MasteringChemistry HW assignment. Students were allowed multiple attempts per question, but were deducted for incorrect answer submissions. On this question, students scored an average of 94.9% on the first part, and 98.3% on the second part, and the target was met. **Result:** Target Met **Year This Assessment Occurred:**	10/08/2014 - A quiz or exam question on these concepts may be a more accurate assessement of student understanding of this material. It is unknown if some students are sharing answers or working together when answering these questions.

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		2013-2014	
	Assessment Method: Data was collected from student work on a series of questions presented in the third in-class Chem 1A midterm during the Winter 2015 quarter. First, students were asked to reason with a diagram of an atomic spectrum of the Hydrogen atom and identify the spectral lines. This required students to understand the visual representation and reason with the graph and given numbers. In a following question, students were asked to look at a set of ionization energy data to determine the electronic structure of an unknown atom. Lastly, students were asked to analyze data from an absorption spectroscopy experiment to identify the mass percent of copper in an unknown compound. All of these questions directly pushed students to reason with data and graphs in ways that linked their chemical understanding to experimental observations. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Since this was an in-class exam, a target rate of 70% was expected.	09/25/2015 - Fifty-one students completed this page of this exam, and the average result was a 59.2% **Result:** Target Not Met **Year This Assessment Occurred:** 2014-2015 **Related Documents:** SLO1_Exam question.pdf	09/25/2015 - Students struggled greatly with the concept of atomic spectra and energy levels (this has been seen in past quarters as well). Students also struggle with the concept of absorption spectroscopy. More time should perhaps be devoted to these two subjects because they are integral techniques to understand in the field of analytical chemistry. More time and practice should be given to students to allow them to greater understand these concepts.
	Assessment Method: Students were given a question on the Final exam that tested their understanding of a emission spectrum and its relationship to a energy diagram of a hypothetical one electron atom. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Since this was an in-class exam, a target rate of 70% was expected.	06/29/2016 - Of the 60 students who were enrolled in Chem 1A Section 1,2, and 7 at the time of the final exam only 52 students took the final. In order to receive full credit a student must be able to covert wavelength of a emission line to a energy difference. With the energy difference they are required to identify the transitions in a diagram. Of the 52 students, 31 students answered the question correctly. 7 students received partial credit for the problem but were able to calculate the energy difference for the emission. 14 students received no credit as the question was left unanswered, or it was misinterpreted as a	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		hydrogen emission spectrum. The success rate was 37/52 or 71%. **Result:** Target Met **Year This Assessment Occurred:** 2015-2016 **Related Documents:** Question 2 Final Exam Spring 2016	
Department - Chemistry (CHEM) - CHEM 1A - GENERAL CHEMISTRY - Applying Scientific Method - A student who successfully masters the material in Chemistry 1A at Foothill College will apply the scientific method in lab experiences to interpret information and draw conclusions. (Created By Department - Chemistry (CHEM)) **Start Date:** 01/09/2012 **End Date:** 06/30/2014 **Course-Level SLO Status:** Active	**Assessment Method:** All questions were assessed online through Mastering General Chemistry in Quiz format. Three questions were assessed. Two questions involved differentiating between physical and chemical properties/changes using given experimental descriptions/data. One question required students to determine the amount of liquid contained in two different graduated cylinders to the correct precision of the device. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Average score of 80% with 90% participation.	05/05/2012 - 100% of the students participated in the assessment with an average score of 87.2%. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012 **GE/IL-SLO Reflection:** The IL-SLO was met.	08/27/2012 - No action plan at this time.
	Assessment Method: In one of the laboratory experiments in Chemistry 1A, the density of 7up and Diet 7up was investigated. Students were asked at the beginning of class to write down their hypothesis as to which had the greater density. During the end of the data analysis period on day 2, a class discussion was held to interpret results. Students were subsequently asked to write down on the report sheet how their resulting data matched with their initial hypothesis. **Assessment Method Type:** Discussion/Participation **Target for Success:**	10/11/2013 - Compared to past quarters when I taught this course, I found the quality of discussion to be much higher this quarter. Students were engaged in discussing their hypotheses. I took a class poll on their initial hypotheses and we explored in-depth the reasons why one type of soda might be more dense than another. Afterwards, students again seemed engaged and interested in the outcome. After discussing the results, students answered the lab question which had them reevaluate their initial hypothesis in writing. In past quarters, usually a handful of students incorrectly answered this (either from a lack of understanding or from careless mistakes). However, this quarter, all but 2 students (out of 58)	10/11/2013 - I would like to think of a way to more formally evaluate "discussion". I could perhaps develop some sort of rubric or set of guidelines on the types of things I am looking for in regards to class participation.

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
	The quality of discussion was assessed to gauge student understanding. The written lab work was assessed to see if students successfully evaluated their hypothesis. A success rate of 90% was targeted for the written lab work.	evaluated their hypothesis correctly. Overall, students got an average of 90.0% on the lab. **Result:** Target Met **Year This Assessment Occurred:** 2012-2013	
	Assessment Method: A question from the MasteringChemistry online HW assignment was used to assess understanding of the scientific method. In the question, a scenario is presented and students are asked to apply the scientific method to arrive at some conclusions about the task. (see notes for scenario). **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** A average score of 80% was targeted.	10/08/2014 - 57 students answered the question. For the 3-part question, 100% of the students were able to select the correct answer before their attempts expired. For the 3 multiple choice question parts, there were only 0.4, 0.2 and 0.9 wrong attempts per student. All students were able to eventually ascertain that the experimenter should perform experiments to test the hypothesis, collect data and refine their hypothesis as needed. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	10/08/2014 - A quiz or exam question on this same concept may yield more accurate data on student understanding of this topic. It is unknown if some students are sharing answers or working together when solving these questions.
	Assessment Method: In planning for this assessment, four questions from an online pre-laboratory assignment were planned to be used to judge understanding of concepts related to the scientific method. The program used was Connect (http://connect.mheducation.com/). However, in practice, three of the questions had severe bugs (or faulty wording) in the online platform and accurate data was not able to be collected. Only data from one question was used in this current year's **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** An 85% success rate was set since student had access to their resources and materials.	09/25/2015 - Fifty-six student completed the online pre-lab assignment. Out of this group, the average score on this question was a 93.04%. Students overwhelming were able to answer this question correctly. **Result:** Target Met **Year This Assessment Occurred:** 2014-2015 **Related Documents:** SLO2_PreLab question.pdf	09/25/2015 - For next year, the bugs in the remaining three questions need to be worked out, so all 4 questions on the Scientific Method can be used to assess student understanding of the concept for this SLO.
	Assessment Method: In one of the laboratory experiments in	04/21/2016 - All students were able to calculate average and range correctly. With that data	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
	Chemistry 1A, the density of 7up and Diet 7up was investigated. Students were asked to measure volume using a graduated cylinder, volumetric pipet and buret. With that data they were asked to calculate density. During the end of the data analysis period on day 2, students were asked to write down on the report sheet which device was the most precise and which device was the least accurate. They were required to support their answer with data. **Assessment Method Type:** Class/Lab Project **Target for Success:** The quality of discussion was assessed to gauge student understanding. The written lab work was assessed to see if students can interpret their data accurately. A success rate of 90% was targeted for the written lab work.	everyone was able to correctly identify the most precise device and the least accurate device. Many students asked very thoughtful questions and realized that the data that they decided to keep can affect their results. **Result:** Target Met **Year This Assessment Occurred:** 2015-2016	
Department - Chemistry (CHEM) - CHEM 1A - GENERAL CHEMISTRY - Critical Thinking Skills - A student who successfully masters the material in Chemistry 1A at Foothill College will demonstrate the ability to think critically and employ critical thinking skills. (Created By Department - Chemistry (CHEM)) **Start Date:** 01/09/2012 **End Date:** 10/28/2017 **Course-Level SLO Status:** Active	**Assessment Method:** All questions were assessed online through Mastering General Chemistry in Quiz format. Seven different questions were used. The questions chosen addressed a variety of critical thinking skills. Students were required to correctly record a measurement and access its precision, to complete a multistep dimensional analysis problem, to interpret and draw conclusions from diagrams, to interpret and draw conclusions from videos/animations and to correctly describe/interpret energy transfer. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Average score of 80% with 90%	05/05/2012 - 93.5% participation was achieved with an average of 75.1%. **Result:** Target Not Met **Year This Assessment Occurred:** 2010-2011 **GE/IL-SLO Reflection:** The average score of the accessed students is near the target score. There were problems detected in the methods of evaluation. (See reflection/action plan.) Evaluation methods that better differentiate abilities will be explored.	08/27/2012 - Three of the questions used were the primary cause of not meeting the target score. One of these three questions involved an energy diagram (average of 62.5%) that was not covered/discussed in detail during class time. More class time will be devoted to developing an understanding of energy diagrams. A second question was a multistep, complex dimensional analysis problem (average of 54.3 %) with no partial credit. It is likely that many students were able to complete part of this multi-step problem correctly, but received zero credit. It would be preferable to

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
	participation.		evaluate this type of question using a hand graded exam/quiz where better differentiation of abilities can be accessed. The third question involved a numerical calculation of energy released during a reaction (average score 66.0%) where correct units for the answer were kJ. Students who input kJ/mole lost all credit for their answer, even if it was numerically correct. Again, this type of question would be better served on a hand graded exam/quiz where better differentiation of abilities can be accessed.
	Assessment Method: Scores on written questions administered during in-class midterm and final exams were used to assess students' critical thinking skills. Questions were chosen that pushed students' analytical reasoning skills. Question #1 was from the second midterm and asked students to reason and calculate all species present in a final solution. This was a complex problem and involved reasoning skills in a limiting reagent problem. Students had to analyze each of four species, and keep track of quantity reacted and state of matter, performing concentration calculations. Question #2 was from the final exam and students applied their knowledge of thermochemistry to an applied context of a scientist designing a new product, a cold pack. Students had to reason with the experimental design limited by the supplied parameters. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:**	10/11/2013 - Question #1: 58 students completed the item. The average score was 75.4% Question #2: 58 students completed the item. The average score was 81.8% **Result:** Target Not Met **Year This Assessment Occurred:** 2012-2013	10/11/2013 - The thermochemistry problem (Ave=81.8%) was administered at the end of quarter, and I presume students had more time to synthesize concepts and practice with the calculations. It would be interesting next year to have this same assessment administered during midterm 2 and then again at the final exam to judge progress or growth. Question #1 (Ave=75.4%) was given during the middle of the quarter, and it was the first time students were assessed on these calculations. It is hypothesized that a similar item on the final exam would give a higher success rate.

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
	All students participated in the in-class exams. An average score of 80% was targeted for each item.		
	Assessment Method: Scores on written questions administered during in-class midterm and final exams were used to assess students' critical thinking skills. Questions were chosen that pushed students' analytical reasoning skills. Question #1 was from the second midterm and asked students to reason and calculate all species present in a final solution. This was a complex problem and involved reasoning skills in a limiting reagent problem. Students had to analyze each of four species, and keep track of quantity reacted and state of matter, performing concentration calculations. Question #2 was from the final exam and students applied their knowledge of thermochemistry to an applied context of a scientist designing a new product, a cold pack. Students had to reason with the experimental design limited by the supplied parameters.(See attached for exact questions asked) **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** A average score of 80% was targeted. **Related Documents:** Q3_critical_thinking.pdf Qfinal_critical.pdf	10/08/2014 - For Question #1, 55 students answered the question. The average score was 22.3/28, and the 80% target was met. For Question #2, 56 students answered the question. The average score was 28.1/36 = 78%. The target was not met, but the performance was very close to the target value. **Result:** Target Not Met **Year This Assessment Occurred:** 2013-2014	10/08/2014 - Students performed well on the solution stoichiometry question (#1), but an average score of only 78% was achieved for the thermochemistry question. This may indicate a need to spend more time in lecture covering concepts of energy in chemical reactions and heat transfer.
	Assessment Method: Data was collected for 2 online homework (Mc-Graw Hill Connect system - http://connect.mheducation.com) questions related to quantitative thinking skills across three different sections of Chem 1A in the Winter 2015 quarter. Chapter 4, #3 required	09/21/2015 - Data was collected from students over 4 different sections of the course. Data was pooled from two different instructors. Out of the student group, a few students scored a zero on the question. This may be due to an inactive account (students stopped attending the class) or the student may not have even attempted the	09/21/2015 - These numbers may be artificially high, because I am only including nonzero answers in the pool. It is possible that some students attempted the question but scored a zero. It is not possible to

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
	students to calculate a final concentration upon mixing two solutions, NaCl and Na2SO4. This question involved more reasoning than a simple dilution calculation. Chapter 4, #8 also asked students to reason with the chemical equation and stoichiometry to determine how much of a compound must be used to neutraliza a spill. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Since this was an online HW setting and students could use the textbook and class resources, a target success rate of 85% was expected.	question at all. When these students were removed from the group, the following results were found Chapter #4, #3 – Out of 89 students (out of 111) who attempted the problem, the average score was 96.1% Chapter #4, #8 – Out of the 92 (out of 111) students who attempted the problem, the average score was 94.3% **Result:** Target Met **Year This Assessment Occurred:** 2014-2015 **Related Documents:** SLO3_Online HW questions - text.pdf	tease out this information in the online data-reporting tool - so it may be useful to think about collecting this data in a slightly different way, perhaps by using an online quiz.
	Assessment Method: Students were asked to employ critical thinking skills on a final exam problem from Spring 2016. The electron configuration that belongs to the atom with the highest second ionization energy is In order to answer the question correctly, a student must interpret the electron configuration and identify the atom that has 1 valance electron. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 70% of students who took the assessment answered the question correctly.	06/29/2016 - 23 of 52 students (44%) who took the final in Spring 2016 were able to answer this question correctly. Students who are unable to answer this question incorrectly answered because they are unable to write the make the connection between highest 2nd ionization energy and configuration. I believe they did not fully understand that the definition of 2nd ionization energy in relation to 1st ionization energy and valence electrons. **Result:** Target Not Met **Year This Assessment Occurred:** 2015-2016 **Related Documents:** Critical thinking SLO.pdf	11/09/2016 - I do not think that a all or nothing multiple choice question is reflective of a student's critical thinking skills. In the future I would like to employ a low stakes assessment.
Department - Chemistry (CHEM) - CHEM 1A - GENERAL CHEMISTRY - Quantitative/Critical Thinking Skills in	**Assessment Method:** All questions were assessed online through Mastering General Chemistry in Quiz format.	05/05/2012 - 93.9% participation was achieved with an average of 80.9%. **Result:**	08/27/2012 - The students that were evaluated successfully demonstrated several basic

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
General Chemistry - A student who successfully masters the material in Chemistry 1A at Foothill College will demonstrate the quantitative skills needed to succeed in General Chemistry. (Created By Department - Chemistry (CHEM)) **Start Date:** 01/09/2012 **End Date:** 06/30/2014 **Course-Level SLO Status:** Active	Seven different questions were used. The questions chosen addressed a variety of skills. The questions included a multistep dimensional analysis problem, unit conversions between mass/molecules/moles, stoichiometric calculations, calculations involving energy and problems related to quantum chemistry. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Average score of 80% with 90% participation.	Target Met **Year This Assessment Occurred:** 2011-2012 **GE/IL-SLO Reflection:** The SLO was met and it does involve a variety of computational and critical thinking skills, some of which also apply to GE. However, this SLO is related more closely to Learning Outcomes related to success in future chemistry classes than to GE.	quantitative skills needed to succeed in subsequent courses.
	Assessment Method: Scores on written questions administered during in-class midterm and final exams were used to assess students' quantitative and critical thinking skills. These questions were complex and highly mathematical, integrating varied concepts from the course. Question #1 was from the third midterm and dealt with the Bohr model of the Hydrogen atom, electron energy levels, and ionization energy, all parts consisted of varied quantitative calculations. Question #2 was from the final exam and consisted of determining an empirical formula from given combustion data. This involved many conversions and multi-part calculations. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** All students participated in the in-class exams. An average score of 80% was targeted for each item.	10/11/2013 - Question #1: 58 students completed the item. The average score was 78.2% Question #2: 58 students completed the item. The average score was 90.0% **Result:** Target Not Met **Year This Assessment Occurred:** 2012-2013	10/11/2013 - The Empirical Formula question (Ave=90.0%) was administered at the end of quarter, and I presume students had more time to synthesize concepts and practice with the calculations. It would be interesting next year to have this same assessment administered during midterm 1 and then again at the final exam to judge progress or growth. Question #1 (Ave=78.2%) was given during the middle of the quarter, and it was the first time students were assessed on these calculations. It is hypothesized that a similar item on the final exam would give a higher success rate.
	Assessment Method: A short pop quiz was given in class to test student understanding of conversion factors and dimensional analysis. See attached file for questions asked. The quiz was scored out of a total of 5	10/08/2014 - 45 students took the pop quiz in lecture (out of a total of 56 students who were enrolled at the time of the quiz). Thus the participation rate was 80%. The average score on the quiz was a 3.9/5 = 77%	10/08/2014 - I think the participation target was probably set too high. An 80% participation during lecture is still a good result, with 77% average on the quiz very close to the target.

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
	points. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** A average score of 80% was targeted with a participation rate of 90%. **Related Documents:** Quiz_011614.pdf	**Result:** Target Not Met **Year This Assessment Occurred:** 2013-2014	For future SLO assessments, it may be better to use scheduled exams that students know about ahead of time to improve the participation rate. Overall, the results of the quiz were very close to the target.
	Assessment Method: Data was collected for 2 online homework (Mc-Graw Hill Connect system - http://connect.mheducation.com) questions related to quantitative thinking skills across three different sections of Chem 1A in the Winter 2015 quarter (N = 112). The first question (Chapter 1, #11) dealt with a complicated dimensional analysis problem (see attached) and the second question (Chapter 3, #11) dealt with the mass of an excess reactant remaining in a chemical stoichiometry problem. Both questions required higher orders of thinking and pushed students to think critically about concepts involved. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Since this was an online HW setting and students could use the textbook and class resources, a target success rate of 85% was expected.	09/21/2015 - Data was collected from students over 4 different sections of the course. Data was pooled from three different instructors. Out of the student group, a few students scored a zero on the question. This may be due to an inactive account (students stopped attending the class) or the student may not have even attempted the question at all. When these students were removed from the group, the following results were found Chapter #1, #11 – Out of 80 students (out of 112) who attempted the problem, the average score was 95.4% Chapter #3, #11 – Out of the 83 (out of 105) students who attempted the problem, the average score was 93.1% **Result:** Target Met **Year This Assessment Occurred:** 2014-2015 **Related Documents:** SLO4_Online HW questions - text.pdf	09/21/2015 - These numbers may be artificially high, because I am only including nonzero answers in the pool. It is possible that some students attempted the question but scored a zero. It is not possible to tease out this information in the online data reporting tool. Even with this caveat, it seems as if students are being very successful across sections on these types of questions. For future data collection, it may be useful to think about collecting data in a different way (perhaps an online quiz) to get a better picture of student understanding
	Assessment Method: Students were given a challenging dimensional analysis problem on the final in order to determine if they had the quantitative skills necessary to succeed in General Chemistry. **Assessment Method Type:** Exam - Course Test/Quiz	06/29/2016 - Of the 60 students who were enrolled in Chem 1A Section 1,2, and 7 at the time of the final exam only 52 students took the final. In order to receive full credit a student must be able to 1. determine the volume of a sphere; 2. use density to convert the volume of sphere to mass of a sphere; 3. use the percent mass of each sphere to determine the amount of nickel required to	06/29/2016 - More time and practice should be given to students to allow them to exercise their critical thinking and quantitative skills. I will continue to work through problems during lecture and employ active learning strategies to get students

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
	Target for Success: Since this was an in-class exam, a target rate of 70% was expected.	make the sphere; and 4. use the mass of nickel given and the the amount of nickel required to make a sphere to find the total amount of spheres that could be made. Of the 52 students, 27 students answered the question correctly, 4 students made a small mathematical mistake which resulted in a few points deducted. 15 students received partial credit (7/15 points) for the problem as they attempted the problem and was only able to solve for volume and mass of a sphere; they were unable to relate it to % mass of a sphere. 6 students left the question unanswered or was unable to solve the problem. The success rate was 31/52 or 60%. **Result:** Target Not Met **Year This Assessment Occurred:** 2015-2016 **GE/IL-SLO Reflection:** Computation Complex problem-solving skills,apply mathematical concepts and reasoning, and ability to analyze and use numerical data. Creative, Critical, and Analytical Thinking Problem solving through analysis. **GE/IL-SLO Reflection:** Computation Complex problem-solving skills,apply mathematical concepts and reasoning, and ability to analyze and use numerical data. Creative, Critical, and Analytical Thinking Problem solving through analysis.	comfortable with these types of problems.
Department - Chemistry (CHEM) - CHEM 1AH - HONORS GENERAL CHEMISTRY - Graphing Functions and Data Analysis - A student who successfully masters the material in Chemistry 1AH at Foothill College will be able to read and interpret graphs,			

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
data and functions, including analysis of the first derivative and the integral of several functions. (Created By Department - Chemistry (CHEM)) **Start Date:** 10/01/2017 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 1AH - HONORS GENERAL CHEMISTRY - Critical Thinking Skills - A student who successfully masters the material in Chemistry 1AH at Foothill College will demonstrate the ability to think critically and employ critical thinking skills. (Created By Department - Chemistry (CHEM)) **Start Date:** 10/01/2017 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 1AH - HONORS GENERAL CHEMISTRY - Quantitative/Critical Thinking Skills in General Chemistry - A student who successfully masters the material in Chemistry 1A at Foothill College will demonstrate the quantitative skills needed to succeed in General Chemistry. These will include the minimal use of calculus. (Created By Department - Chemistry (CHEM)) **Start Date:** 10/01/2017 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 1B - GENERAL CHEMISTRY - Quantitative Skills in General Chemistry - Global: Demonstrate the quantitative skills needed to succeed in General Chemistry. (Created By Department - Chemistry (CHEM))	**Assessment Method:** At two times during the quarter, student quantitative skills were analyzed using a subset of Midterm exam questions. #1. Three quantitative question on the gas laws were given on the first page of the first	09/19/2016 - On the gas laws assessment on midterm #1: 55 students completed the item with an average score of 77.7% On the acids/pH assessment on midterm #2: 53 students completed the item, with an average	09/19/2016 - Students had much more success with the gas laws problem than with the problems on acids and pH. More review/practice should be provided to students on

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Start Date: 01/09/2012 **Course-Level SLO Status:** Active	midterm exam. #2. Three quantitative questions on pH, concentration, % ionization on acids were given on the last page of the second midterm exam. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** a 70% success rate was targeted for students **Related Documents:** Exam Questions	score of 64.3% On average between the 2 assignments, the score was: 71.0% **Result:** Target Met **Year This Assessment Occurred:** 2015-2016	acids, since the problems are considerably more complex and harder to grasp. This should be noted in future instruction.
	Assessment Method: All questions were assessed online through Mastering General Chemistry in Quiz format. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Average score of 80% with 90% participation.	04/30/2012 - The results are based on 11 multiple choice questions covering multiple chapters. On average, the results were 86% correct with 95% participation. These questions are targeted at the concepts and skills necessary to progress to the next topic/chapter in chemistry. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012	04/30/2012 - The results are very satisfactory. As instructors with years of experience we are aware of and continually stress those topics that are necessary to succeed in general chemistry. We will continue to make success with this SLO a top priority in our classes.
	Assessment Method: Online homework through Mastering General Chemistry, by Pearson. **Assessment Method Type:** Departmental Questions **Target for Success:** Succes would be B-, 78% percentage score. This reflects the ability of an average 1B student.	10/10/2014 - The use of mastering Chemistry to asses students Quantitative skills seems to be very reflective of the student population. We use a series of mathematical based questions that involve several steps and analysis. We used 104 questions from the online homework. There was 71.3% completion with an average score of 93.4%. This meets our target success of 78%. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** Noe at this time.	
		10/11/2013 - The results are based on 110 multiple choice questions covering multiple chapters. On average, the results were 89% correct with 78% participation. These questions	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		are targeted at the concepts and skills necessary to progress to the next topic/chapter in chemistry. **Result:** Target Met **Year This Assessment Occurred:** 2012-2013	
	Assessment Method: All questions were assessed online through Mastering General Chemistry in Quiz format. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Average score of 80% with 90% participation.		
	Assessment Method: Laboratory Quiz stressing mathematical analysis of data and problem solving. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Passing score with 65% or better.	03/03/2016 - The average for the students laboratory quizzes was a 75%, which shows that the majority of students are successful in demonstrating this skill. **Result:** Target Met **Year This Assessment Occurred:** 2015-2016	
		12/08/2015 - The average score was 73% with a median of 75%. These questions primarily were on kinetics, heavy on the quantitative reasoning and mathematical skills. The students did about as expected, the low average is common for kinetics problems. Note: 29% of the students did not meet the target. **Result:** Target Met **Year This Assessment Occurred:** 2014-2015	
Department - Chemistry (CHEM) - CHEM 1B - GENERAL CHEMISTRY - Graphing and Data Analysis - Global: Read and interpret graphs and data. (Created By Department - Chemistry (CHEM))	**Assessment Method:** Three questions from the second midterm exam were analyzed to gauge students' ability in reading and interpreting graphs and data. The first question asked to students to	09/19/2016 - A total of 50 students completed the exam question. Students had a success rate of 74.1%. A majority of students were able to correctly read and reason with both a table of concentration and rate values, as well as with a	09/19/2016 - In future quarters, similar types of assessments can be given to see if student mastery of these concepts is being upheld. The high rate of success points to

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Start Date: 01/09/2012 **Course-Level SLO Status:** Active	make predictions on the rate of reaction given a set of parameters. The second question gave students a set of concentration and rate data for 4 experiments and had them determine the rate law and rate of reaction. The third question showed students a plot of concentration over time and had students reason with it. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** a 70% success rate was targeted for the class. **Related Documents:** Exam#2, Q1	plot of concentration over time. (see attachment for exact questions) **Result:** Target Met **Year This Assessment Occurred:** 2015-2016	the conclusion that students are able to successfully reason with these graphs and data.
	Assessment Method: A quiz is given to the students in lab that reflects their lab experiments and requires them to read and interpret graphical data. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** To be successful on this quiz a student must score 70% or higher.		
	Assessment Method: Quiz given in laboratory based on experiments where graphing interpretation was stressed and required. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 65% or better average on quiz/exam questions.	12/08/2015 - The students did very well analyzing and interpreting a graph of gas density versus pressure. The average and median grade were both 80%. We continually stress the interpretation of graphs throughout chemistry. By the time the students reach 1B, they seem to be very comfortable with graphical analysis. Note: 17% of the students that did not meet the 65% score. **Result:** Target Met **Year This Assessment Occurred:** 2014-2015	
	Assessment Method: All questions were assessed online through Mastering General Chemistry in Quiz format.		

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
	Assessment Method Type: Exam - Course Test/Quiz **Target for Success:** Average score of 80% with 90% participation.		
	Assessment Method: Online homework through Mastering General Chemistry, by Pearson. **Assessment Method Type:** Departmental Questions **Target for Success:** Succes would be B-, 78% percentage score. This reflects the ability of an average 1B student.	10/10/2014 - We used 24 questions from the homework data base. The average score was 93.4% with 69.7% participation. Participation is low so the average score may be skewed to a higher than normal value. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** None at this time.	
		10/11/2013 - We used a data base of 27 online questions with a participation of 74%. The average score for the 27 questions was 85%. This is much better than previous years, since we have made an effort to select those questions that are more closely aligned with our course content. **Result:** Target Met **Year This Assessment Occurred:** 2012-2013	
	Assessment Method: All questions were assessed online through Mastering General Chemistry in Quiz format. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Average score of 80% with 90% participation.	04/30/2012 - The average score based on three problems was 74% with 94% participation. The low average was the result of assigning problem 11.59 from the 12th edition of Brown and Lemay. The students only scored an average of 57%. The other two questions had results that were more reflective of our target goals. **Result:** Target Not Met **Year This Assessment Occurred:** 2011-2012	10/11/2013 - More carefully select representative problems from the textbook for assessment. 04/30/2012 - Problem 11.59 was reviewed and will not be assigned in the future. This problem required reading a graph to a finer precision then could be expected from a computer image. It is understandable that students answered this question incorrectly.

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Department - Chemistry (CHEM) - CHEM 1B - GENERAL CHEMISTRY - Critical Thinking Skills - Global: Demonstrate the ability to think critically and employ critical thinking skills. (Created By Department - Chemistry (CHEM)) **Start Date:** 01/09/2012 **Course-Level SLO Status:** Active	**Assessment Method:** All questions were assessed online through Mastering General Chemistry in Quiz format. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Average score of 80% with 90% participation.	04/30/2012 - We assessed 31 multiple choice questions sampled randomly from every chapter. The average score was 87% with a participation of 96%. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012	04/30/2012 - The results are very satisfactory. As instructors with years of experience we are aware of and continually stress critical thinking skills. The logical thinking and problem solving aspect of general chemistry is the core of the discipline. Without these skills, students will soon meet their limitations as there pursue their science degrees and move into the workforce.
	Assessment Method: Online homework through Mastering General Chemistry, by Pearson. **Assessment Method Type:** Departmental Questions **Target for Success:** Succes would be B-, 78% percentage score. This reflects the ability of an average 1B student.	10/10/2014 - We used a homework set of 46 problems coverall all chapters and subjects. Th average score was 88.2 with 64.6% completion rate. This is the most difficult of the assessments for the students as reflected in the low participation rate. We are pleased with the results as this 1B class performed below average compared to previous quarters. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** None at this time.	
		10/11/2013 - The results are based on 72 multiple choice questions covering multiple chapters. On average, the results were 79% correct with 67% participation. These questions give a good overview of students ability to process and utilize multiple skills learned throughout the course. The 79% could be a little higher but this SLO is probably the hardest for students, and one we make every effort to reinforce during the quarter.	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		Result: Target Met **Year This Assessment Occurred:** 2012-2013	
	Assessment Method: All questions were assessed online through Mastering General Chemistry in Quiz format. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Average score of 80% with 90% participation.		
	Assessment Method: Laboratory Quiz on Data Analysis **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Passing grade of 65%.	12/08/2015 - The average and median were both 75%. However, 22% of the students did not meet the target. This is typical, about 20% of students are not successful in chemistry 1B and is reflected consistently in the grades on quizzes and exams. **Result:** Target Met **Year This Assessment Occurred:** 2014-2015	
	Assessment Method: A question on the Final exam for the course was analyzed to understand students' critical thinking skills. The item was a complex question involving thermodynamics, equilibrium/ICE tables and the dependence of the equilibrium constant on temperature. It was a challenging and complicated question that asked for student's critical thinking and analysis skills. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** Because of the complex and challenging nature of the question, a target of 65% (passing) was targeted.	09/19/2016 - A total of 53 students completed the final exam item. They earned an average score of 67.25%. Overall, most students were able to reason through most parts of the question. Most students were able to construct the ICE table and recognize the temperate dependence of the equilibrium constant. **Result:** Target Met **Year This Assessment Occurred:** 2015-2016	09/19/2016 - Instruction should focus on more complex, involved questions such as these, to push students in their critical thinking and increase student scores in future quarters.

Department - Chemistry (CHEM) - CHEM 1BH - HONORS GENERAL CHEMISTRY -

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Graphing and Function Analysis - A student who successfully masters the material in Chemistry 1BH at Foothill College will be able to read and interpret graphs, data and functions, including analysis of the first derivative and the integral of several functions. (Created By Department - Chemistry (CHEM)) **Start Date:** 10/01/2017 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 1BH - HONORS GENERAL CHEMISTRY - Critical Thinking Skills - A student who successfully masters the material in Chemistry 1BH at Foothill College will demonstrate the ability to think critically and employ critical thinking skills. (Created By Department - Chemistry (CHEM)) **Start Date:** 10/01/2017 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 1BH - HONORS GENERAL CHEMISTRY - Critical Thinking Skills in General Chemistry - A student who successfully masters the material in Chemistry 1BH at Foothill College will demonstrate the quantitative skills needed to succeed in General Chemistry. These will include the minimal use of calculus. (Created By Department - Chemistry (CHEM)) **Start Date:** 10/01/2017 **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 1C - GENERAL CHEMISTRY & QUALITATIVE	**Assessment Method:** Online course homework.	06/27/2011 - The statistics from Mastering Chemistry are as follows for question 17.107 11th	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
ANALYSIS - Solubility of Salts - Critical Thinking - A successful student will demonstrate the ability to make connections between concepts across several areas of General Chemistry as applied to salt solutions. (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Quarter **Course-Level SLO Status:** Active	**Assessment Method Type:** Departmental Questions **Target for Success:** An average of 75% for the class.	ed. of Brown and Lemay. 70% Correct, 7% Unfinished, 23% Incorrect **Result:** Target Not Met **Year This Assessment Occurred:** 2010-2011 **GE/IL-SLO Reflection:** This question requires students to recall concepts from 1st quarter general chemistry. The students that answer incorrectly usually miss the stoichiometry aspect of the question.	07/11/2011 - These values, although not meeting our target, are reasonable considering the complexity of the assessment.We see no need to take significant action at this time to alter our curriculum.
	Assessment Method: Chemistry 1C Final Exam - Multiple Choice Question. The Ksp for Zn(OH)2 is 5.0x10-17. Determine the molar solubility of this salt in a buffer solution with a pH of 11.50. A) 5.0x10-12 B) 5.0x10-17 C) 2.3x10?6 D) 1.6x10-14 E) 1.2x10-13 **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** An average of 70% correct for the class.	06/26/2012 - This question was given to 61 students during the final exam of Sp 2012. 72% of the students answered this question correctly. Considering the dificulty of this question 72% is acceptable. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012	08/27/2012 - This question involves recognition that buffer solutions provide a constant pH. This must be factored into the mathematics before the final solution can be determined. The low score of 72% may be careless error by some students in forgetting to square the [OH-] concentration or substituting [H+] fro [OH-] in the mathematics. A review/reminder to carefully step through the problem solving algorithm is in order.
Department - Chemistry (CHEM) - CHEM 1C - GENERAL CHEMISTRY & QUALITATIVE ANALYSIS - Electrochemistry - Computation - A successful student will demonstrate the ability to think critically and employ computational skills in the analysis of redox reactions and chemistry. (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active	**Assessment Method:** Online course homework. **Assessment Method Type:** Departmental Questions **Target for Success:** An average of 75% for the class.	06/27/2011 - The statistics from Mastering Chemistry are as follows for question 20.100 11th ed. of Brown and Lemay. 73% Correct, 10% Unfinished, 17% Incorrect **Result:** Target Not Met **Year This Assessment Occurred:** 2010-2011 **Resource Request:**	07/11/2011 - These values, although not meeting our target, are reasonable considering the complexity of the assessment. We see no need to take significant action at this time to alter our curriculum.

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		None at this time. **GE/IL-SLO Reflection:** This question requires students to consider several factors when formulating their answers. The students that answer incorrectly usually miss one (or more) critical thinking step when answering.	
	Assessment Method: Chemistry 1C Final Exam - Multiple Choice Question. The standard emf for the cell using the overall cell reaction below is +2.20 V: 2Al(s)+3I2(s) ?> 2Al3+(aq)+6I-(aq) The emf generated by the cell when [Al3+] = 4.5 ! 10-3 M and [I-] = 0.15 M is ? V. A) 2.23 B) 2.39 C) 2.20 D) 2.10 E) 2.30 **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** This is a difficult problem. A 70% success rate would be terrific!	06/26/2012 - On the final exam from Spring of 2012, 67% percent of the students answered this correctly, just missing the target of 70%. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012	08/27/2012 - This question is based on the Nernst equation - a conceptually difficult equation for many students to master. To reach a target of 70% correct, I plan to spend more time in lecture and lab on the use and permutations of this question.
	Assessment Method: Final Exam-Section on Redox Chemistry involving critically thinking for both quantitative and qualitative questions. The questions were a mix of open ended problem solving, multiple choice and written explanation. Students were required to show understanding of electrochemistry topics that included batteries, cell-potential, corrosion, voltaic and electrolytic cells, and current flow. Students were also required to integrate concepts learned within the general chemistry sequence, such as pH, free energy, and spontaneity of reactions. **Assessment Method Type:** Exam - Course Test/Quiz	10/15/2016 - Winter quarter of 2016 the class average was 69.1%; thus the target for success was not achieved within this group of 21 students. Spring quarter of 2016 the class average was 79.6%; the the target for success was achieved within this group of 43 students. The weighted average, including both quarters was 76.2%; the target for success was met for the aggregate group. A similar pattern was observed for success between winter and spring quarters of 2014, with spring students significantly out-performing winter students. There are logical factors that contribute to the difference in success in chemistry 1C between winter and spring quarters. The winter	11/30/2016 - Further investigate the population difference between Winter and Spring students. Determine the number of students in Winter that are repeating the course for a second time. Consider Surveying students to determine subject-matter weaknesses that may be addressed in STEM center workshops. 10/15/2016 - A member of the department is currently on PDL developing a series of assessments

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
	Target for Success: An average of 75%, which is a "C+" grade.	students are "off sequence" and are more at risk for the following reasons: The vast majority of the spring students begin the general chemistry sequence in the fall, and complete it at a "normal pace" and in a smooth fashion by the end of spring. The winter students either begin the sequence the prior spring, with a summer gap before taking chemistry 1B, or they take chemistry 1A at a much greater pace during the summer quarter. When a gap occurs in the sequence, students will start to forget essential knowledge and skills. When covered at a fast pace, students do not have adequate time to fully develop their understanding and skills. Since chemistry 1C integrates skills and knowledge from through-out the course sequence, the results are not surprising. **Result:** Target Met **Year This Assessment Occurred:** 2015-2016	to determine each student's level of readiness and/or mastery of essential skills needed to succeed within the general chemistry series for chemistry 1A and 1B. The assessments will then be linked to booster modules designed to address gaps in student knowledge/skills as they progress through these two courses, thus leaving students better prepared for the rigors of chemistry 1C. The goal is to improve student success within the entire sequence over all, although at risk students may benefit the most.
Department - Chemistry (CHEM) - CHEM 1C - GENERAL CHEMISTRY & QUALITATIVE ANALYSIS - Nuclear Chemistry - A successful student will demonstrate an understanding of the impact of science on society in the area of nuclear chemsitry. (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active	**Assessment Method:** Online homework. **Assessment Method Type:** Departmental Questions **Target for Success:** An average of 75% for the class.	06/27/2011 - The statistics from Mastering Chemistry are as follows for question Nuclear Generation of Electric Power, 11th ed. of Brown and Lemay. 99% Correct, 1% Unfinished, 0% Incorrect **Result:** Target Met **Year This Assessment Occurred:** 2010-2011 **Resource Request:** Noe at this time. **GE/IL-SLO Reflection:** This question was conceptual in nature, looking at how nuclear power is used to generate electricity. The students did extremely well on this question indicating their ability to read and apply there understanding of nuclear decay to the global	07/11/2011 - In class we emphasize the use of nuclear power as a source of energy. The students can take this information and see how electrical energy production can be solved using nuclear power.

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		problem of energy production.	
	Assessment Method: Final Exam-Section on Nuclear Chemistry. The questions were a mix of open ended problem solving, multiple choice and written explanation. Students were required to show understanding of nuclear chemistry topics that included types of nuclear decay and their interaction with matter, nuclear fission versus nuclear fusion and their limitations/uses, calculations of energy released in nuclear processes and kinetics of nuclear decay. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** An average of 75%, which is a "C+" grade	10/15/2016 - This was assessed during spring quarter 0f 2016. The class average was 72.6%; a little under the target for success. **Result:** Target Not Met **Year This Assessment Occurred:** 2015-2016	10/15/2016 - Nuclear Chemistry is the last topic covered in Chemistry 1C. The final exam during this quarter took place less than a week after the class finished covering the subject. Students may not have sufficient time to fully understand the new material while also studying for a cumulative final exam. Perhaps a lower success rate of 70% is more reasonable.
Department - Chemistry (CHEM) - CHEM 1C - GENERAL CHEMISTRY & QUALITATIVE ANALYSIS - Colligative Properties - Critical Thinking - A successful student must be able to recognize the types of salts presented as strong or non-electrolytes. Secondly, perform the required critical thinking/mathematical analysis of the experimental data to select the one salt that satisfies the conditions given. (Created By Department - Chemistry (CHEM)) **Start Date:** 06/26/2012 **Course-Level SLO Status:** Active	**Assessment Method:** Chemistry 1C Final Exam - Multiple Choice Question. A 1.35 m aqueous solution of compound X had a boiling point of 101.4°C. Which one of the following could be compound X? The boiling point elevation constant for water is 0.52°C/m. A) C6H12O6 B) CH3CH2OH C) KCl D) CaCl2 E) Na3PO4 **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** 75% correct would be considered acceptable given the difficulty of the problem.	06/26/2012 - On the final exam from Spring of 2012, 87% of the students answered this question correctly. Far exceeding the target of 75%. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012	08/27/2012 - The results are very good indicating students can recognize and solve a single step math problem with a high degree of certainty. The 13% that gave an incorrect answer may have carelessly missed the square function in the math. No action seems to be required at this time.
Department - Chemistry (CHEM) - CHEM 1C - GENERAL CHEMISTRY & QUALITATIVE	**Assessment Method:** Students were asked the following question	10/11/2013 - The overall findings were that 70% of the students scored a grade of 3 out of 4 points on	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
ANALYSIS - Laboratory Techniques - Students will demonstrate an understanding of how to execute common laboratory techniques. (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Quarter **Course-Level SLO Status:** Active	on an open lab notebook lab exam: You need to prepare 100 ±1 mL of a buffer that is 0.15 M acetic acid and 0.40 M sodium acetate. The reagents that you have available are 1.00-M HCl, and solid sodium acetate trihydrate. Write step by step instructions on how to prepare the buffer using appropriate lab equipment. (Note that students calculated the reagent amounts in a previous part of the question. Incorrectly calculated amounts of reagents did not impact grading of this part of the question.) **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** This question was assessed out of 4 points. Individual students were considered successful if they earned at least 3 out of the 4 points, or 75%. Target for success was 80% of the class earning a minimum of 3 out of the 4 points possible.	the question. The most common mistake was choosing incorrect glassware for preparing the solution. The correct choice, given the precision indicated by the question, was a 100 mL graduated cylinder. A number of students choose to use a beaker, an inaccurate and imprecise device. This error resulted in a 2 point deduction. Other students choose to use a 100 mL volumetric flask, a device with much greater precision, and requiring more effort to use, than required. This resulted in a 1 point deduction. **Result:** Target Not Met **Year This Assessment Occurred:** 2012-2013 **Resource Request:** None **GE/IL-SLO Reflection:** The results indicate that, although students spend a good deal of time in Chemistry 1B and 1C in preparing laboratory notebooks (summarizing procedures, recording data, etc.) a rather large proportion of the students do not acquire the knowledge and judgement needed to determine the correct volumetric equipment needed to prepare a solution of known concentration from a set of given reagents.	10/11/2013 - To prepare for laboratory activities, students in Chemistry 1B and 1C are required to write a summary of each procedure in their notebook. The students are provided detailed procedures, written by faculty, to refer to as they prepare their notebook. The procedures provided include specifics about what equipment to use. The "Action Plan" recommended is that specifics about what equipment to use be slowly eliminated from experimental procedures provided as student progress through their studies in Chemistry 1B and into 1C. Thus, as students gain more experience, they will be required to think about the correct choice of equipment, such as glassware, when preparing their notebook. Doing so will encourage the students to be more independent and will help them develop a deeper, more complete understanding of proper lab techniques.
Department - Chemistry (CHEM) - CHEM 1C - GENERAL CHEMISTRY & QUALITATIVE ANALYSIS - Identification of ions in solution- Scientific inquiry and lab techniques - Successful students will illustrate separation and identification schemes using flow diagrams and apply principles of aqueous solubility equilibria to separate and identify the ions in a solution. (Created By Department - Chemistry (CHEM))	**Assessment Method:** One of the most demanding requirements in Foothill's Chemistry 1C laboratory program is the qualitative analysis of a small sample of a solution containing six different unknown cations, an individual project that spans the last four weeks of the course. Student results for correct identification of the ions in their sample solution during spring quarter of 2014 were tabulated and	10/10/2014 - A total of 38 students passed the class; 22 of the passing students correctly identified all 6 ions and 15 of the passing students correctly identified 5 out of the 6 ions in their sample solution. Thus, 97.4% of passing students correctly identified at least 5 out of the 6 ions. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Assessment Cycles: End of Quarter **Course-Level SLO Status:** Active	summarized. **Assessment Method Type:** Class/Lab Project **Target for Success:** Students who earn a passing grade in Chemistry 1C should have developed the skills needed to identify at least 5 out of the 6 ions correctly. Target for success is set at 90% of passing students achieving this goal.	**Resource Request:** Preparation of the individual unknown samples and the reagents needed for analysis is labor intensive for the stockroom personnel. Continued support of the stockroom with the current level of at least 2 technicians is needed.	
Department - Chemistry (CHEM) - CHEM 1C - GENERAL CHEMISTRY & QUALITATIVE ANALYSIS - Global Learning Outcome-Impact on Society - The successful student will demonstrate an understanding of the impact of science on society. (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Academic Year **Course-Level SLO Status:** Active	**Assessment Method:** The students were asked to determine the validity of the following question: In nuclear power plants energy is generated from a critical mass of radioactive fuel, therefore a nuclear explosion is possible. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** At least 80% of the class should be able to correctly answer this question.	11/03/2015 - Only 60% of the students could correctly answer the question. **Result:** Target Not Met **Year This Assessment Occurred:** 2014-2015 **Resource Request:** None **GE/IL-SLO Reflection:** The concept that nuclear power plants do not use a critical mass of radioactive fuel was discussed in lecture. However, this was not reinforced with related homework questions. Reinforcing the concept with work assigned outside of class is recommended to increase the success rate.	11/03/2015 - Although this concept was discussed during lecture, it was not reinforced with related homework questions. Reinforcing the concept with work/research assigned outside of class is recommended to increase the success rate.
Department - Chemistry (CHEM) - CHEM 25 - FUNDAMENTALS OF CHEMISTRY - Physical and Chemical Properties and Change - The students will be able to identify physical and chemical properties and change (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active	**Assessment Method:** Results from selected assignments in the online homework system will be compiled and reviewed. **Assessment Method Type:** Departmental Questions **Target for Success:** Correct response rates from 70 to >90% will be targeted depending on the timing (within the term) and the difficulty of the selected assignment.	10/29/2015 - The exercise that follows was chosen to evaluate SLO #2 and was administered by in Winter and Spring quarters 2015 through the required online homework component of the course. The exercise asks students to categorize several properties of a compound as chemical or physical. This topic is covered in the first two weeks of the course. The students were comfortable with the exercise, with an average score of 74.8% and 76.4% for the W15 and S15 quarters, respectively.	10/29/2015 - No action plan needed 04/29/2011 - Target met; no change recommended

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		Result: Target Met **Year This Assessment Occurred:** 2014-2015 **Resource Request:** None **GE/IL-SLO Reflection:** This is a straightforward topic which is presented very early in the quarter and the majority of students should be able to complete the exercise successfully. The success rate in the mid-to high seventies is acceptable, but may be slightly lower than reality since some students are slower to master the online homework system.	
Department - Chemistry (CHEM) - CHEM 25 - FUNDAMENTALS OF CHEMISTRY - Dimensional Analysis - The students will be able to use dimensional analysis to set up and solve numerical problems. (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active	**Assessment Method:** Results from selected assignments in the online homework system will be compiled and reviewed. **Assessment Method Type:** Departmental Questions **Target for Success:** Correct response rates from 70 to >90% will be targeted depending on the timing (within the term) and the difficulty of the selected assignment.	11/25/2016 - An assessment of the overall success of the students in solving problems requiring quantitative skills was made through the online homework system. Average percent success rates were examined for assignments early and late in the course for triple sections taught during WQ16 and SQ16. Early in the quarter, when math skills and new quantitative concepts are being introduced, the average success rates were higher than typical, being greater than 90% for both quarters on a multi-part problem. This multi-part probem focused on unit conversion skills, significant figures and dimension analysis problems. Later in the quarter, the success rates remained high for these types of problems, with success rates of greater than 90% maintained on selected homework problems that required unit conversions. **Result:** Target Met **Year This Assessment Occurred:** 2015-2016 **GE/IL-SLO Reflection:** In a homework setting, where multiple	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		attempts (with a small penalty) are permitted, high success rates are expected. In the quarters assessed for 2016, higher scores on a multiple part dimensional analysis problem were achieved than the previous year. This earlier mastery of unit analysis skills may reflect a focus on completing practice worksheets in class during these quarter that was instituted during these quarters. The improvement that was noted in the average success rates for quantitative skills based questions is encouraging, although withdrawal of less successful students from the course may skew the results slightly. The success rates for these Chem25 sections were generally superior to the aggregate Mastering Chemistry system scores. No changes are recommended other than continued practice and reinforcement of problem solving skills in class using worksheets or other methods.	
		10/29/2015 - An assessment of the overall success of the students in solving problems requiring quantitative skills was made through the online homework system. Average percent success rates were examined for assignments early and late in the course for triple sections taught during WQ15 and SQ15. Early in the quarter, when math skills and new quantitative concepts are being introduced, the average success rates ranged from 66-88% (WQ15) and 80 - 94% (SQ15) over a series of problems. These early problems focused on unit conversion skills, significant figures and dimension analysis problems. Later in the quarter, the success rates improved, with success rates of 86-95% (WQ15) and 82-97% (SQ15). **Result:** Target Met **Year This Assessment Occurred:** 2014-2015	10/29/2015 - No change recommended. The implementation of graded online homework will continue to be a vital component in ensuring students are learning the importance of dimensional analysis. The online homework system used has recently added an adaptive follow-up component which will be used to supplement SLO assessments in future years.

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		Resource Request: none **GE/IL-SLO Reflection:** No change recommended. In a homework setting, where multiple attempts (with a small penalty) are permitted, high success rates are expected. The improvement that was noted in the average success rates for quantitative skills based questions is encouraging, although withdrawal of less successful students from the course may skew the results slightly. Comparison of online homework scores with in-class test results is generally good. The online homework system used has recently added an adaptive follow-up component which will be used to supplement SLO assessments in future years.	
Department - Chemistry (CHEM) - CHEM 25 - FUNDAMENTALS OF CHEMISTRY - Mole and Avogadro's Number - The students will understand the meaning and uses of the mole and of Avogadro's number. (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active	**Assessment Method:** Results from selected assignments in the online homework system will be compiled and reviewed. **Assessment Method Type:** Departmental Questions **Target for Success:** Correct response rates from 70 to >90% will be targeted depending on the timing (within the term) and the difficulty of the selected assignment.	09/27/2014 - A multi-part exercise (Conversions involving moles) designed to assess the student's understanding of the concept of the law of conservation of mass and the mole to mass conversions necessary to use this law was selected for the assessment. The correct response rate for Foothill Chem 25 students continued to be 96% for this exercise, compared with 90% for the Mastering Chemistry database. This suggests most students are able to develop a solid understanding of this concept and are able to perform the simple unit conversions necessary to complete the exercise. Based on a review of incorrect answers submitted during the assignment, most errors involved incorrect calculations of numbers with exponents and a failure to predict/recognize an answer that is too large or small to make physical sense. **Result:** Target Met **Year This Assessment Occurred:**	09/27/2014 - In future terms, students will be directed to practice worksheets on dimensional analysis and scientific notation on the course website to allow targeted practice of areas of weakness. The concept of estimating answers and evaluating calculated results for physical feasibility will be stressed during in class problem solving.

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		2013-2014 **Resource Request:** none **GE/IL-SLO Reflection:** Students in Chem 25 have a wide range of math competencies, which impacts their success in mastering necessary problem solving skills in chemistry. Though almost all students ultimately answered this series of questions correctly, the incorrect responses provide some insight into ways to improve student outcomes. In future terms, students will be directed to practice worksheets on dimensional analysis and scientific notation on the course website to allow targeted practice of areas of weakness. The concept of estimating answers and evaluating calculated results for physical feasibility will be stressed during in class problem solving.	
		06/22/2013 - A multi-part exercise (Conversions involving moles) designed to assess the student's understanding of the concept of the law of conservation of mass and the mole to mass conversions necessary to use this law was selected for the assessment. The correct response rate for Foothill Chem 25 students was 96% for this exercise, compared with 90% for the Mastering Chemistry database. This suggests most students have a solid understanding of this concept and are able to perform the simple unit conversions necessary to complete the exercise. **Result:** Target Met **Year This Assessment Occurred:** 2012-2013 **GE/IL-SLO Reflection:** These are core concepts (Avogadro's number and the meaning and uses of the concept of moles) in chemistry and high performance on this exercise is critical for	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		continued student success in chemistry courses. This assignment was competed near the middle of the term and indicated the students had successfully integrated these concepts.	
		04/27/2012 - A question designed to assess the student's understanding of the concept of the law of conservation of mass and the mole to mass conversions necessary to use this law was selected for the assessment. The correct response rate for Foothill Chem 25 students was 99% for this exercise, compared with 93% for the Mastering Chemistry database. This suggests most students have a solid understanding of this concept and are able to perform the simple unit conversions necessary to complete the exercise. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012 **GE/IL-SLO Reflection:** This assessment is very positive, however, the data include only those students who completed this homework exercise. It is possible that the true percentage of students who have mastered these concepts is lower than the very high percentage indicated by the scores, if poorly performing students did not answer this question. This potential limitation of the online homework system will be considered in future assessments	
		04/29/2011 - The exercises that follow were chosen to evaluate SLO #3 and were administered by all Chemistry 25 faculty in Winter 2011 through the required online homework component of the course: (Exercise 6.54: Problems ? The Mole Concept) A salt crystal has a mass of 0.12 mg. How many NaCl formula units does it contain?	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		(Exercise 6.86: Problems ? Calculating an Empirical Formula) Samples of several compounds are decomposed, and the following are the masses of their constituent elements. Calculate the empirical formula for a compound containing 0.672 g Co, 0.569 g As, 0.486 g O There were two separate exercises chosen to more fully assess the scope of mastery regarding the important, yet broad, concept of the mole. Both exercises were quantitative. For (1), the correct response rate of 89% was reassuring that this important objective is being mastered by the majority of students. For (2), the percentage of correct answers dropped to 73%, with many students incorrectly proposing a formula that matches a more common form of the arsenate polyatomic ion but does not match the formula that would have been derived from the data given. This suggests that students may have done an internet search for the compound rather than doing the necessary calculations. **Result:** Target Met **Year This Assessment Occurred:** 2010-2011 **GE/IL-SLO Reflection:** It is important to do examples that showcase the different pitfalls of assuming, for example, an ionic compound composed of Fe and O is not necessarily assumed to be FeO (iron(II) oxide), because perhaps the data would calculate another stable form: Fe2O3 (iron(III) oxide).	
Department - Chemistry (CHEM) - CHEM 25 - FUNDAMENTALS OF CHEMISTRY - Comprehension of chemical reactivity and quantitative relationships in chemical equations - Students will be able to recognize basic patterns of chemical	**Assessment Method:** Performance on relevant homework exercises completed using Mastering Chemistry (online homework site) was assessed for all or selected sections of	11/25/2016 - Student performance was assessed on homework problems which required understanding of the targeted concepts. The exercises included writing and balancing the relevant chemical equations, as well as	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
reactivity, express reactions in terms of balanced equations and be able to determine quantities of reactants and products in terms of moles, mass and volumes of solutions. (Created By Department - Chemistry (CHEM)) **Start Date:** 01/09/2012 **End Date:** 03/30/2012 **Course-Level SLO Status:** Active	Chem 25 for the relevant term. Foothill performance was also compared to system data available for students that answered the specific problem from all institutions using the Mastering Chemistry system. **Assessment Method Type:** Departmental Questions **Target for Success:** At least 80% of students who completed the questions should be able tocomplete the selected exercises correctly. Foothill performance should be at least as good as the system data.	determining quantities of products that would be produced from the reactions, given specified quantities of reactants. The questions requiring calculations using reactant quantities were answered correctly by 95% or more of the Foothill students compared with 93% of the correct response rates in the system database, indicating the target for success was met. Students were in Winter quarter 2016 were not as successful in answering a question on writing and balancing a chemical equation (66% correct vs, the system rate of 80%), though Spring quarter 2016 students achieved a correct response rate of 87%. **Result:** Target Met **Year This Assessment Occurred:** 2015-2016 **GE/IL-SLO Reflection:** The scores were generally high for these exercises, indicating students are mastering the concepts of calculating quantities of reactants and products, using stoichiometry and mole ratios in the context of homework. Because students in Winter quarter 2016 did not appear to be as successful in answering a question on writing and balancing a chemical equation (66% correct vs. the system rate of 80%), the wrong answers given were evaluated and responses to additional questions on balancing chemical equations were assessed. Most of the incorrect responses on the target problem were due to students incorrectly noting the phase (S, L, G) of a reactant or product, rather than errors in balancing the equation or identifying the reactants and products. The correct response rates to other homework questions on balancing equations were quite high (>90%).	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		09/27/2014 - Students were required to complete two multi-part exercises on solubility and precipitation reactions (“PHET Simulation” and “Solubility and Precipitation Reactions”. The exercises included writing and balancing the relevant chemical equations, as well as predicting whether the solubility of the products would result in a precipitate as one of the products. The questions was answered correctly by 91 and 96% of the Foothill students compared with 79 and 88% correct response rates in the system database, indicating the target for success was met. The higher success on the second exercise is likely due to repetition of the concept within the homework assignment, since it one of the last problems in the homework assignment. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** none **GE/IL-SLO Reflection:** The scores were quite high for this exercise, indicating students are mastering the concepts of precipitations reactions, solubility and how to interpret the information given in a solubility table. Incorrect answers suggested there was a slight learning curve in using the solubility table, but that students mastered the concepts with repetition within the exercise.	
		06/22/2013 - Students were required to complete two multi-part exercises on solubility and precipitation reactions (“PHET Simulation” and “Solubility and Precipitation Reactions”. The exercises included writing and balancing the relevant chemical equations, as well as predicting whether the solubility of the products would result in a precipitate as one of the products. The questions was answered correctly by 81 and 89%	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		of the Foothill students compared with 79 and 88% correct response rates in the system database, indicating the target for success was met. The higher success on the second exercise is likely due to repetition of the concept within the homework assignment, since it one of the last problems in the homework assignment. **Result:** Target Met **Year This Assessment Occurred:** 2012-2013	
		04/27/2012 - Students were required to complete a multi-part exercise on solubility and precipitation reactions. The exercise included writing and balancing an equation, as well as predicting whether the solubility of the products would result in a precipitate as one of the products. The question was answered correctly by 91% of the Foothill students compared with an 89% correct response rate in the system database, indicating the target for success was met. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012 **GE/IL-SLO Reflection:** This SLO encompasses several key concepts and skills which should be mastered by Chem 25 students. The exercise was of moderate difficulty and the high correct response rate suggests the emphasis on these concepts in the classroom was appropriate.	
Department - Chemistry (CHEM) - CHEM 30A - SURVEY OF INORGANIC & ORGANIC CHEMISTRY - Chemical Equations and Formulas - Students will be able to represent chemical changes correctly through balanced chemical equations with	**Assessment Method:** The following problem for SLO#3 is used in the online homework grading system (Mastering Chemistry) for students in all sections of Chemistry 30A. Mastering Chemistry homework problems are used in	06/29/2016 - This assessment was performed on in Chem 30A Section 03 in Spring 2016. Of the 28 students enrolled in the this section at time of assessment, 100% of the students answered the question correctly. This shows that the learning outcome has been met for these students.	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
proper formulas for elements and compounds. (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active	preparation for course examinations (pretesting). Chapter 5, Problem #7: Which is the correct equation for the reaction of magnesium with hydrochloric acid to produce hydrogen and magnesium chloride? A. 2 Mg + 6 HCl → 3 H2 + 2 MgCl2 B. Mg + HCl ->H + MgCl C. Mg + 3 HCl ->3 H + MgCl2 D. Mg + 2 HCl -> 2 H + MgCl2 E. Mg + 2 HCl -> H2 + MgCl2 *Note: formatting for subscripts and arrows did not copy over to TracDat **Assessment Method Type:** Pre/Post Test **Target for Success:** Students who are able to successfully answer this problem have mastered SLO #3. Overall success is indicated by a minimum of 70% of students successfully completing this problem.	**Result:** Target Met **Year This Assessment Occurred:** 2015-2016 **Resource Request:** None **GE/IL-SLO Reflection:** This SLO achieves institutional learning outcome of Computation since students were required to perform decision analysis (synthesis and evaluation) in order to property predict the reactants and products of the chemical reaction. 09/21/2015 - Data from the online homework for Chemistry 30A section 03 from Spring 2015 was used to assess this SLO. 100% of the 34 students enrolled in the course were able to correctly answer this homework problem in the online homework assignment. This indicates that students are learning how to write chemical formulas and chemical equations correctly. **Result:** Target Met **Year This Assessment Occurred:** 2014-2015 06/23/2014 - Data from the online homework for Chemistry 30A section 01 from Spring 2014 was used to assess this SLO. 100% of the 34 students enrolled in the course were able to correctly answer this homework problem in the online homework assignment. This indicates that students are learning how to write chemical formulas and chemical equations correctly. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 06/18/2013 - 100% of the 32 students enrolled in Chemistry 30A section 04 in spring 2013 got this problem right on the online homework practice. This indicates that students are learning how to	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		write chemical formulas and chemical equations correctly. **Result:** Target Met **Year This Assessment Occurred:** 2012-2013	
		03/13/2012 - 100% of students assessed in winter 2012 were able to correctly answer this question. This shows that students are mastering SLO#3. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012	
Department - Chemistry (CHEM) - CHEM 30A - SURVEY OF INORGANIC & ORGANIC CHEMISTRY - Matter Classification - Students will be able to classify matter correctly. (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active	**Assessment Method:** The following problem for SLO#1 is used in the online homework grading system (Mastering Chemistry) for all students enrolled in Chemistry 30A. These homework assignments are used in preparation for course examinations (pretest). Prelab #2, Classifying Matter: Classify the following as an element, compound or mixture: Vitamin D, salt water, oxygen, maple syrup, fruit salad, water, gold **Assessment Method Type:** Pre/Post Test **Target for Success:** Students who are able to correctly classify the substances given in this problem have mastered SLO #1. Overall success is indicated by a minimum of 70% of students successfully completing this problem.	06/18/2013 - 78.1% of the 32 students enrolled in Chemistry 30A section 04 got this problem correct in the online homework. The most common error was that students sorted one out of the six choices incorrectly, which indicates that the majority of students to miss this problem still had a good understanding of how to classify matter correctly. **Result:** Target Met **Year This Assessment Occurred:** 2012-2013	
		03/13/2012 - In the winter of 2012, 93.3% of students assessed were able to correctly answer this question. This indicates that our students are able to successfully classify matter. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012	
	Assessment Method: The following problem for SLO#1 is used in the online homework grading system (Mastering Chemistry) for all students enrolled in Chemistry 30A. These homework assignments are used in preparation for	06/29/2016 - This assessment was performed on in Chem 30A Section 03 in Spring 2016. Of the 28 students enrolled at the time the assignment was due, only 25 students answered the question. 72% of the students answered the question correctly while 28% of the students didn't finish the	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
	course examinations (pretest). Prelab #2, Classifying Matter: Classify each of the pure substances as an element or a compound. silicon, gold, gaseous ammonia **Assessment Method Type:** Pre/Post Test **Target for Success:** Students who are able to correctly classify the substances given in this problem have mastered SLO #1. Overall success is indicated by a minimum of 70% of students successfully completing this problem.	question or answer correctly. The most common mistake was to classify ammonia as a mixture when it is a pure substance. The % correct for this section is 2% greater than the system average which demonstrate success in this learning outcome. **Result:** Target Met **Year This Assessment Occurred:** 2015-2016 **Resource Request:** None **GE/IL-SLO Reflection:** This SLO meets the institutional learning outcome of creative, critical, and analytical thinking skills. Students were required to use their best judgement and research skills to classify matter.	
		09/21/2015 - Data from the online homework for Chemistry 30A section 03 from Spring 2015 was used to assess this SLO. 88.2% of the 34 students enrolled in the course were able to correctly answer this homework problem in the online homework assignment. This shows that the target was met for this SLO. **Result:** Target Met **Year This Assessment Occurred:** 2014-2015	
		06/23/2014 - Data from the online homework for Chemistry 30A section 01 from Spring 2014 was used to assess this SLO. 84.8% of the 34 students enrolled in the course were able to correctly answer this homework problem in the online homework assignment. This indicates that our students are able to successfully classify matter. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Department - Chemistry (CHEM) - CHEM 30A - SURVEY OF INORGANIC & ORGANIC CHEMISTRY - Measurements and Equipment - Students will be able to use common laboratory equipment correctly and report measurements to the correct significant figures with proper units. Equipment includes Bunsen burners, beakers, graduated cylinders, thermometers, top loading balances, rulers and burets. (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active	**Assessment Method:** The following problem for SLO#2 is used in the online homework grading system (Mastering Chemistry) for students enrolled in Chemistry 30A. These homework assignments are used as a pretest in preparation for course exams. Problem #90 from Chapter 1: Which choice best describes the uncertainty in the measurement 16.30 g? A. cannot be determined B. quantity is exact C. +/- 0.01 g D. +/- 0.10 g E. +/- 1.00 g **Assessment Method Type:** Pre/Post Test **Target for Success:** Students who are able to correctly answer this question have mastered SLO #2. Overall success is indicated by a minimum of 70% of students successfully completing this problem.	06/29/2016 - This assessment was performed on in Chem 30A Section 03 in Spring 2016. Of the 28 students enrolled in the class at the time the assignment was due, only 27 students answered the question. 96.3% of the students answered the question correctly while 3.7% of the students didn't finish the question or answered it incorrectly. The % correct for this section is greater than the system average which demonstrate success in this learning outcome. **Result:** Target Met **Year This Assessment Occurred:** 2015-2016 **Resource Request:** None **GE/IL-SLO Reflection:** This outcome fulfills the institutional learning outcomes for Computation by analyzing numerical data and for Critical Thinking by problem solving through analysis. **GE/IL-SLO Reflection:** This outcome fulfills the institutional learning outcomes for Computation by analyzing numerical data and for Critical Thinking by problem solving through analysis. 09/21/2015 - Data from the online homework for Chemistry 30A section 03 from Spring 2015 was used to assess this SLO. 100% of the 35 students enrolled in the course were able to correctly answer this homework problem in the online homework assignment. This shows that the target was met for this SLO. **Result:** Target Met **Year This Assessment Occurred:** 2014-2015 06/23/2014 - Data from the online homework for Chemistry 30A section 01 from Spring 2014 was	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		used to assess this SLO. 100% of the 34 students enrolled in the course were able to correctly answer this homework problem in the online homework assignment. This shows that the target was met for this SLO. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014	
		06/18/2013 - Data from the online homework for Chemistry 30A section 04 was used to assess this SLO. 96.8% of the 32 students enrolled in the course were able to correctly answer this homework problem in the online homework assignment. This shows that the target was met for this SLO. **Result:** Target Met **Year This Assessment Occurred:** 2012-2013	
		03/13/2012 - In winter 2012, 100% of students correctly answered this question. This indicates that our students are able to understand the precision of their measurements made with common lab equipment. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012	
Department - Chemistry (CHEM) - CHEM 30B - SURVEY OF ORGANIC & BIOCHEMISTRY - Organic Compounds - Students will be able to name simple organic compounds and recognize and name functional groups in an organic compound. By recognizing a functional group, students will be able to determine general reactivity	**Assessment Method:** The following question will be used in all Chem 30B courses as part of the assigned chapter homework in preparation for course examinations: Chapter 12, Problem #39: The name of the hydrocarbon with three carbon atoms and having only single bonds	06/30/2016 - For the 18 students enrolled in Chemistry 30B Section 03 at the start of Spring 2016, the average score for this problem was 100%. **Result:** Target Met **Year This Assessment Occurred:** 2015-2016	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
and write reactions to show that reactivity. (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active	between carbon atoms is A. decane. B. ethane. C. propane. D. butane. E. methane. **Assessment Method Type:** Pre/Post Test **Target for Success:** Average student score 70% or higher.	09/21/2015 - For the 25 students enrolled in Chemistry 30B Section 01 at the start of Spring 2015, the average score for this problem was 100%. **Result:** Target Met **Year This Assessment Occurred:** 2014-2015 06/23/2014 - For the 21 students enrolled in Chemistry 30B Section 03 at the start of Winter 2014, the average score for this problem was 100%. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 06/18/2013 - For the 24 students enrolled in Chemistry 30B at the start of spring 2013, the average score for this problem was 91.7%. **Result:** Target Met **Year This Assessment Occurred:** 2012-2013 06/13/2012 - The average student score for this problem was 98.7% in spring 2012, suggesting student mastery of basic hydrocarbon nomenclature. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012	
Department - Chemistry (CHEM) - CHEM 30B - SURVEY OF ORGANIC & BIOCHEMISTRY - Bio-molecules - Students will be able to describe the general structure of carbohydrates, fatty acids, amino acids and proteins, nucleotides and nucleic acids. Students will know the roles of these bio-molecules in the body. (Created By	**Assessment Method:** All students will be assigned the following problem in homework in preparation for course exams. Chapter 25, Problem #22: The backbone of a nucleic acid molecule consists of A. alternating sugar and nitrogen base	06/30/2016 - For the 18 students enrolled in Chemistry 30B Section 03 at the start of Spring 2016, 84.6% of students answered the question correctly, while 15.4% of students answered the question incorrectly or left it unanswered. The most common mistake students made was indicating a amide bond is between a sugar and phosphate group.	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active	groups linked by amide bonds. B. alternating sugar and phosphate groups linked by phosphate ester bonds. C. complementary bases joined by hydrogen bonds. D. sugar molecules bonded from the #3 carbon of one molecule to the #5 carbon of the other by glycosidic linkages. E. alternating nitrogen bases and phosphate groups linked by amide bonds and strengthened by hydrogen bonds. **Assessment Method Type:** Pre/Post Test **Target for Success:** A student average of 70% or higher for this problem.	**Result:** Target Met **Year This Assessment Occurred:** 2015-2016 09/21/2015 - For the 15 students that remained enrolled in Chemistry 30B Section 01 in the middle of Spring 2015, the average score for this problem was 100%. **Result:** Target Met **Year This Assessment Occurred:** 2014-2015 06/23/2014 - For the 21 students enrolled in Chemistry 30B Section 03 at the start of Winter 2014, the average score for this problem was 100%. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 06/18/2013 - The average score for this problem was 85.3% for all Chemistry 30B students in section 1 for spring 2013. **Result:** Target Met **Year This Assessment Occurred:** 2012-2013 06/13/2012 - The average student score was 89% in spring 2012. This shows that students understanding the structure of bio-molecules, in this case nucleic acid structure. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012	
Department - Chemistry (CHEM) - CHEM 30B - SURVEY OF ORGANIC & BIOCHEMISTRY - DNA - Students will be able to describe DNA replication,	**Assessment Method:** All students will be assigned the following homework problem in preparation for course exam:	06/30/2016 - For the 18 students enrolled in Chemistry 30B Section 03 at the start of Spring 2016, 100% of students answered the question	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
transcription and translation. (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active	Chapter 25, Problem #45: The process in which information from DNA is used to manufacture RNA is called A. replication. B. mutation. C. translocation. D. translation. E. transcription. **Assessment Method Type:** Pre/Post Test **Target for Success:** Average student score of 70% or higher.	correctly. **Result:** Target Met **Year This Assessment Occurred:** 2015-2016 09/21/2015 - For the 15 students that remained enrolled in Chemistry 30B Section 01 in the middle of Spring 2015, the average score for this problem was 100%. **Result:** Target Met **Year This Assessment Occurred:** 2014-2015 06/23/2014 - For the 21 students enrolled in Chemistry 30B Section 03 at the start of Winter 2014, the average score for this problem was 100%. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 06/18/2013 - In spring of 2013, section 1 had an average score of 93.6% for this problem. **Result:** Target Met **Year This Assessment Occurred:** 2012-2013 06/13/2012 - The average student score was 98% for this problem in spring 2012. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012	
Department - Chemistry (CHEM) - CHEM 30B - SURVEY OF ORGANIC & BIOCHEMISTRY - Common Metabolic Processes - Students will understand the chemistry of common metabolic processes. (Created By Department - Chemistry	**Assessment Method:** All students will be assigned the following homework problem in preparation for course exam: Chapter 20, Problem #22: The common molecule produced from all	06/30/2016 - For the 18 students enrolled in Chemistry 30B Section 03 at the start of Spring 2016 only 13 students answered this question. 92.3% of students answered the question correctly, while 7.7% of students answered the	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
(CHEM)) **Course-Level SLO Status:** Active	foods at the second stage of catabolism is A. ADP. B. glucose. C. acetyl-SCoA. D. carbon dioxide. E. citric acid. **Assessment Method Type:** Pre/Post Test **Target for Success:** 70% or higher student average	question incorrectly or left it unanswered. **Result:** Target Met **Year This Assessment Occurred:** 2015-2016 09/21/2015 - For the 16 students that remained enrolled in Chemistry 30B Section 01 in the middle of Spring 2015, the average score for this problem was 100%. **Result:** Target Met **Year This Assessment Occurred:** 2014-2015 06/23/2014 - For the 21 students enrolled in Chemistry 30B Section 03 at the start of Winter 2014, the average score for this problem was 100%. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 06/18/2013 - In spring 2013, section 1 averaged 98.7% on this problem. **Result:** Target Met **Year This Assessment Occurred:** 2012-2013 06/13/2012 - Average student score for this problem was 90% in spring 2012. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012	
Department - Chemistry (CHEM) - CHEM 70 - STUDY SKILLS & PROBLEM SOLVING STRATEGIES FOR CHEM 1A - Student Success - Students will master specific problem solving skills needed to succeed in Chemistry 1B and 1C. (Created By	**Assessment Method:** Students who completed Chemistry 70 during the WInter 2011, Spring 2011, Fall 2011, WInter 2012 and Fall 2012 quarter were asked to complete a survey. One of the questions asked was:	10/09/2014 - During the 2013-2014 academic year, Chemistry 70 was offered only fall quarter and during this quarter only 6 students registered for and then completed the course. Therefore, this was a small student population to sample from. Of	10/11/2013 - Providing the materials used to a larger portion of the student population is recommended.

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Department - Chemistry (CHEM)) **Assessment Cycles:** End of Academic Year **Start Date:** 09/20/2013 **End Date:** 10/04/2013 **Course-Level SLO Status:** Active	Please choose the highest level of Chemistry you have successfully completed. Choices included Chemistry 1A, Chemistry 1B, Chemistry 1C **Assessment Method Type:** Survey **Target for Success:** A target of 75% for 1A and 56% for 1B. This was based upon a success rate of 75% in each course. Chemistry 1C is difficult to set a target for since a portion of students do not need Chemistry beyond 1B.	the six students, 100% were successful in passing both Chemistry 1A and 1B during the year. Of the six, 66.7% passed 1C during the academic year. The two students who did not complete 1C are currently in progress; one of them received an incomplete during spring quarter and is working toward completion. **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** Support to offer the material used in Chemistry 70 at the PSME Center on a more flexible schedule in order to provide the materials to a larger student population. The materials used would be best presented by a faculty member.	
Department - Chemistry (CHEM) - CHEM 70 - STUDY SKILLS & PROBLEM SOLVING STRATEGIES FOR CHEM 1A - Study Strategies for College Level Science - The student will develop and apply effective study strategies and skills for the study of college level science. (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active	**Assessment Method:** Study strategies and skills discussed and applied in Chemistry 70 are designed to increase the success rate, defined as a grade of C or better, of students in college level science courses. To access the effectiveness of the Chemistry 70 curriculum, success rates in Chemistry 1A for the class at large were compared with success rates for students who were also concurrently enrolled in Chemistry 70. **Assessment Method Type:** Data **Target for Success:** A Chemistry 1A success rate for students enrolled in Chemistry 70 that exceeds the success rate of those not enrolled in Chemistry 70.	06/29/2012 - The success rate for Chemistry 1A students at large in the group studied was 75.0 %. That is 75.0% of the students enrolled in the course at the end of the second week of classes passed with a grade of C or better. For students in the same course who were concurrently enrolled in Chemistry 70, the success rate was 77.8 %. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012	09/04/2012 - Tracking success of students who completed Chemistry 70 in subsequent courses would provide further information about the success of the course.
Department - Chemistry (CHEM) - CHEM 70 - STUDY SKILLS & PROBLEM SOLVING	**Assessment Method:** All questions were assessed online through	06/29/2012 - The results were as follows:	

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
STRATEGIES FOR CHEM 1A - Problem Solving Skills for Chemistry 1A - The student will demonstrate competency in quantitative problem solving skills related to Chemistry 1A. (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active	Mastering General Chemistry in Quiz format. Average scores for each question were compared for the Chemistry 1A students at large and for for students who were also concurrently enrolled in Chemistry 70. The following questions were assessed. The questions included unit conversions and stoichiometric calculations. 1) A sample of the male sex hormone testosterone, C19H28O2, contains 3.68×10^21 atoms of hydrogen. a. How many atoms of carbon does it contain? b. How many molecules of testosterone does it contain? c. How many moles of testosterone does it contain? d. What is the mass of this sample in grams? 2) The complete combustion of octane, a component of gasoline, proceeds as follows: (Reaction given) a. How many moles of are needed to burn 1.35 mole octaneof ? b. How many grams of oxygen are needed to burn 12.0 g of octane? c. Octane has a density of 0.692 g/mL at 20°C. How many grams of oxygen are required to burn 19.0 gallons of octane? 3) Tartaric acid, has two acidic hydrogens. The acid is often present in wines and precipitates from solution as the wine ages. A solution containing an unknown concentration of the acid is titrated with. It requires 22.65 mL of 0.1500 M solution to titrate both acidic protons in 60.00 of the tartaric acid solution. Calculate the molarity of the tartaric acid solution. **Assessment Method Type:** Exam - Course Test/Quiz **Target for Success:** A higher average score for those students enrolled in Chemistry 70 compared to the	Question 1: Chemistry 1A students at large achieved an average score of 82.9%. Students who were also enrolled in Chemistry 70 achieved an average score of 91.7%. Question 2: Chemistry 1A students at large achieved an average score of 77.2%. Students who were also enrolled in Chemistry 70 achieved an average score of 77.8%. Question 3: Chemistry 1A students at large achieved an average score of 73.2%. Students who were also enrolled in Chemistry 70 achieved an average score of 75.0%. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012	09/06/2012 - The problem solving sessions utilized in Chemistry 70 were found to be successful in improving quantitative skills. However, improvement was slight for question (2). More focus on questions of this type will be given in the Chemistry 70 problem sets.

Course-Level SLOs	Means of Assessment & Targets for Success / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
	Chemistry 1A students at large.		
Department - Chemistry (CHEM) - CHEM 70 - STUDY SKILLS & PROBLEM SOLVING STRATEGIES FOR CHEM 1A - Student Success_1 - Students will master specific problem solving skills needed to succeed in Chemistry 1B and 1C. (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Academic Year **Start Date:** 10/09/2014 **End Date:** 10/09/2014 **Course-Level SLO Status:** Active	**Assessment Method:** Students who completed Chemistry 70 during the Fall 2013 quarter were tracked through the Chemistry 1A, 1B, 1C sequence to monitor their success in completion of the sequence. **Assessment Method Type:** Case Study/Analysis **Target for Success:** A target of 75% for 1A and 56% for 1B. This was based upon a success rate of 75% in each course. Chemistry 1C is difficult to set a target for since a portion of students do not need Chemistry beyond 1B.		
Department - Chemistry (CHEM) - CHEM 9 - CHEMISTRY OF COOKING - Physical and Chemical Properties and Change - The students will be able to identify physical and chemical properties and change (Created By Department - Chemistry (CHEM)) **Course-Level SLO Status:** Active			
Department - Chemistry (CHEM) - CHEM 9 - CHEMISTRY OF COOKING - Interpret physical phenomena - Collect data and interpret real-world physical phenomena using scientific models (Created By Department - Chemistry (CHEM)) **Assessment Cycles:** End of Quarter **Start Date:** 09/01/2016 **End Date:** 09/01/2019 **Course-Level SLO Status:** Active			

Unit Assessment Report - Four Column

Foothill College

Program (PSME - CHEM) - Chemistry AS

PL-SLOs	Means of Assessment & Target / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Program (PSME - CHEM) - Chemistry AS - 1 - Knowledge of current theories and applications in the field of chemistry **SLO Status:** Active	**Assessment Method:** Standardized Achievement and Self-Report Tests: Students will be tested on six core topics in chemistry that correlate to topics used in later assessments (for example, the American Chemistry Society (ACS) General Chemistry Exam, or equivalent, and the ACS Organic Chemistry Chemistry Exam, or equivalent.) **Assessment Method Type:** Exam - Standardized **Target:** Students scoring in the 70 percentile compared to the nation.	09/18/2015 - 32 students took ACS standardized exam in Organic Chemistry(year sequence) Average score was 50.5/70 which is 87th percentile according to published national norms. This exam requires students to draw and interpret chemical structures, to understand how structure relates to reactivity and to understand the connection between molecular rearrangement and both thermodynamics and kinetics. This is an excellent performance relative to National averages (4230 students and 71 colleges reporting) and reflects achievement in this key learning outcome. **Result:** Target Met **Year This Assessment Occurred:** 2014-2015 **Resource Request:** none **Resource Request:** none **Resource Request:** none **Resource Request:** none **GE/IL-SLO Reflection:** This assessment relates to the Institutional learning outcome of Critical, Creative and Analytic thinking. The exam requires a good deal of high level reasoning and so this result reflects high achievement in this category. **GE/IL-SLO Reflection:** This assessment relates to the Institutional learning outcome of Critical, Creative and Analytic thinking. The exam requires a good deal of high level reasoning and so this	09/18/2015 - ACS is working to address potential for cell phone security risks that would compromise this exam. It is of utmost importance to maintain no cell phone policy and to administer test only when the use of cell phones may be easily detected

PL-SLOs	Means of Assessment & Target / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		result reflects high achievement in this category. **GE/IL-SLO Reflection:** This assessment relates to the Institutional learning outcome of Critical, Creative and Analytic thinking. The exam requires a good deal of high level reasoning and so this result reflects high achievement in this category. **GE/IL-SLO Reflection:** This assessment relates to the Institutional learning outcome of Critical, Creative and Analytic thinking. The exam requires a good deal of high level reasoning and so this result reflects high achievement in this category.	
		07/21/2014 - 36 students took the 2012 version of the American Chemical Society's Standardized Exam in Organic Chemistry. Their average score was 51/70 (73%) which places the average in the 88th percentile according to published national norms. This class was an especially strong one and their performance demonstrates the success of our program in fostering this important learning outcome (the knowledge of current theories and applications in the field of chemistry). **Result:** Target Met **Year This Assessment Occurred:** 2013-2014 **Resource Request:** Ongoing support of existing program to ensure its continued effectiveness **GE/IL-SLO Reflection:** The complex and comprehensive nature of this standardized exam and the tremendous performance of our graduating chemistry students demonstrates demonstrates that students are learning to think critically and to apply analytic reasoning to complex	

PL-SLOs	Means of Assessment & Target / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		problems. This directly supports Foothill's creative, critical and analytic thinking Institutional learning outcome.	
		08/07/2013 - A class of 45 students took the 2012 ACS Organic Chemistry Exam and earned an average score of 48/70, placing them in the 83 percentile of the nation. This new version of the exam was more difficult than in previous years but our students were able to still score in a high percentile bracket. This data suggests that students completing the Chem 1A/B/C and Chem 12A/B/C series at Foothill College are well-prepared in comparison to national statistics. **Result:** Target Met **Year This Assessment Occurred:** 2012-2013	
		09/08/2012 - Students completing the 2008 version of the Organic Chemistry Standardized Exam scored an Average of 78%, which corresponds to the 91st percentile according to published National norms. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012 **Resource Request:** Purchase of latest version of Standardized exam **GE/IL-SLO Reflection:** This is a very encouraging result given that this is a comprehensive exam covering material taught not just in Organic Chemistry, but also its pre-requisites throughout our curriculum at Foothill. It demonstrates that our students are transferring having gained substantial knowledge of current theories and applications in Chemistry.	

PL-SLOs	Means of Assessment & Target / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
	Assessment Method: Short answer essay question(s) embedded in Final exam that requires students to analyze data, interpret the results and describe the experimental outcome as it relates to theoretical foundations of chemistry **Assessment Method Type:** Essay/Journal **Target:** Students should be able to earn a subjective score of 70% on this question		
	Assessment Method: Embed a question similar to the following on Final Exam: Draw all possible products of the following reaction. State which product forms faster and which one is more stable. Justify your answer. Draw an energy diagram with intermediates and transition states clearly labelled with their corresponding structures. **Assessment Method Type:** Exam - Course Test/Quiz **Target:** Students should be able to complete this question with 80% accuracy. This question requires students to apply important theoretical constructs to the interpretation of known experimental observations, and as such is an excellent assessment tool of this Program Level Learning Outcome.	11/29/2016 - Average was 34/50 = 68% Students were able to identify the products and label them as kinetic or thermodynamic with high accuracy, but many made errors in the potential energy diagram. Students understand how to interpret these graphical representations of reaction kinetics and thermodynamics, but experience greater difficulty in generating the graphs themselves. In addition, students are less adept at drawing transition state structures (which are less well defined) than they are intermediates. **Result:** Target Not Met **Year This Assessment Occurred:** 2015-2016 **Resource Request:** Support for course coordination/ faculty mentoring and discussion **Resource Request:** Support for course coordination/ faculty mentoring and discussion **Resource Request:** Support for course coordination/ faculty mentoring and discussion **GE/IL-SLO Reflection:** This assessment relates to the Institutional Outcome of Creative, Critical, and Analytic	11/30/2016 - Further evaluation of specific exam questions targeting this outcome are needed. 11/29/2016 - This question requires very clear direction so that students are prompted to address the important elements of the energy diagram. Future efforts to create more opportunities for practice in proposing energy diagrams to match a known mechanism may improve this outcome.

PL-SLOs	Means of Assessment & Target / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		thinking. It specifically targets synthesis and evaluation. This skill is at the foundation of Chemistry and so efforts to improve this outcome is important. More assessment tools targeting this skill should be considered. **GE/IL-SLO Reflection:** This assessment relates to the Institutional Outcome of Creative, Critical, and Analytic thinking. It specifically targets synthesis and evaluation. This skill is at the foundation of Chemistry and so efforts to improve this outcome is important. More assessment tools targeting this skill should be considered. **GE/IL-SLO Reflection:** This assessment relates to the Institutional Outcome of Creative, Critical, and Analytic thinking. It specifically targets synthesis and evaluation. This skill is at the foundation of Chemistry and so efforts to improve this outcome is important. More assessment tools targeting this skill should be considered.	
Program (PSME - CHEM) - Chemistry AS - 2 - An enhanced ability to research, assess and evaluate topics of interest. **SLO Status:** Active	**Assessment Method:** Students will be tested on six core topics in chemistry that correlate to topics used in later assessments (specifically Chem 1C or Chem 12A/B/C). Special end-of-quarter projects involving presentations on how current events relate to chemistry theory may also be utilized. **Assessment Method Type:** Exam - Standardized		
	Assessment Method: Students are asked to carry out a chemical reaction using a series of wet chemical techniques, isolate the product, and then characterize the product using spectroscopy	11/29/2016 - Report average for this lab was 88%. Students worked in pairs, but exhibited strong understanding of chemical procedure and reflected strong ability to assess and evaluate data in order to understand a chemical transformation	

PL-SLOs	Means of Assessment & Target / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
	Students will themselves acquire the spectra and analyze the data in order to deduce the structure. From the structure of the product, students must then infer the lowest energy mechanism of reaction and rationalize their findings using known structure-reactivity relationships. **Assessment Method Type:** Class/Lab Project **Target:** Lab report grades, which require correct data interpretation and articulation of findings should be 80% on average.	**Result:** Target Met **Year This Assessment Occurred:** 2016-2017 **Resource Request:** Instrument Maintenance and Repair **Resource Request:** Instrument Maintenance and Repair **GE/IL-SLO Reflection:** This lab project assesses the Institutional Learning outcome of Creative, Critical, and Analytical Thinking. Students exhibit creativity in hypothesizing outcomes for the chemical reaction in question, and must then exhibit analytic thinking in analyzing their data to arrive at a conclusion. **GE/IL-SLO Reflection:** This lab project assesses the Institutional Learning outcome of Creative, Critical, and Analytical Thinking. Students exhibit creativity in hypothesizing outcomes for the chemical reaction in question, and must then exhibit analytic thinking in analyzing their data to arrive at a conclusion.	
Program (PSME - CHEM) - Chemistry AS - 4 - Facility in the safe handling of chemicals and the execution of common laboratory techniques **SLO Status:** Active	**Assessment Method:** Laboratory safety quizzes will be administered at the beginning of the quarter; or a checklist of laboratory skills demonstrating successful completion of key experiments will also be recorded. **Assessment Method Type:** Observation/Critique **Target:** 80% success rate in passing both safety quiz and satisfying experiment checklist.	11/20/2016 - All students completing CHEM 12C exhibit independence and skill in the following techniques: 1) Recrystallization of a solid 2) Extraction 3) Melting Point determination 4) Neutralizing reactive components prior to waste disposal 5) Recognizing Corrosive versus Flammables and segregating them accordingly **Result:** Target Met **Year This Assessment Occurred:** 2015-2016 **Resource Request:**	

PL-SLOs	Means of Assessment & Target / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		Instrument/ Equipment Maintenance **GE/IL-SLO Reflection:** This learning outcome relates to the Critical Thinking element established as an Institutional learning outcome. By gaining skill in the laboratory, students demonstrate that they can apply reasoning to establish the need for each step in a procedure and that they can then recognize the consequence of each.	
		09/08/2012 - 98% of students passed the take-home safety quiz assigned at the beginning of the quarter. The 2% that did not pass dropped the class by the end of the fourth week. Successful completion of the laboratory experiments assigned during the Chem 12 sequence requires facility with a number of important laboratory skills. While as success rates can be as low as 85% for some experiments, 100% of students enrolled in the course at the end of the Chem 12 sequence had passed the laboratory portion of the course. Not a single student failed a preparative experiment more than twice. **Result:** Target Met **Year This Assessment Occurred:** 2011-2012 **Resource Request:** none **GE/IL-SLO Reflection:** Students are learning to apply knowledge of Chemistry through manipulation and direct observation of matter using careful application of the Scientific method.	
Program (PSME - CHEM) - Chemistry AS - Data Analysis - Students will be able to critically evaluate data to support or refute a hypothesis	**Assessment Method:** Final exam in terminal course (12B or 12C) will include a question in which students will be provided with data and must evaluate	12/04/2016 - Students were presented with product distribution data for reaction of 2-bromopropane with sodium hydroxide in EtOH/H2O at two different temperatures.	

PL-SLOs	Means of Assessment & Target / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
Year PL-SLO implemented: End of Academic Year **Start Date:** 11/30/2016 **End Date:** 11/30/2020 **SLO Status:** Active	data to deduce evidence needed to answer a question related to chemical reactivity. Students must then justify their answers in writing. **Assessment Method Type:** Exam - Course Test/Quiz **Target:** A class average of 75% on this question signifies success in meeting this outcome.	Question posed to students was "Explain the following change in product distribution Note: This question requires data analysis, but does not require students to support or refute a hypothesis. Class average on this question was 43% with a very large standard deviation (.4) 8/28 = 29% of the class received full credit. They correctly identified what the data said and then explained that entropy costs of substitution relative to elimination were the source of this chemical behavior. 15/28 students understood that the data showed that the proportion of Elimination product increased with temperature, but were unable to state a correct reason for this observation. Many did not state a reason at all, apparently believing that the trend identification was itself a sufficient answer. Just 2/8 points were given for this kind of answer, which is why the average on this question was so low. 5/28 = 18% of the class did not receive any credit for this question. They did not address the increased proportion of elimination product at higher temperature, but rather left the question blank or addressed irrelevant aspects of the reaction under investigation. **Result:** Target Not Met **Year This Assessment Occurred:** 2016-2017 **GE/IL-SLO Reflection:** This assessment addresses the Institutional learning outcome for creative, critical and analytic thinking. Students are not routinely analyzing data without it first being filtered or interpreted for them. The weak performance on this answer suggests that this needs to change. **GE/IL-SLO Reflection:** This assessment addresses the Institutional learning outcome for creative, critical and	

PL-SLOs	Means of Assessment & Target / Tasks	Assessment Findings/Reflections	Action Plan & Follow-Up
		analytic thinking. Students are not routinely analyzing data without it first being filtered or interpreted for them. The weak performance on this answer suggests that this needs to change.	
Program (PSME - CHEM) - Chemistry AS - 3 - An enhanced ability to communicate effectively using the language of Chemistry. **Year PL-SLO implemented:** End of Academic Year **SLO Status:** Active	**Assessment Method:** Evaluation of student's laboratory notebook that will contain safety information, step-by-step procedures and clear presentation of data. Additionally, lab reports will be assessed for clear, concise presentation of experimental findings. Group presentations of lab data may also be utilized. **Assessment Method Type:** Essay/Journal		