PROGRAM REVIEW – CURRICULUM PACKET

2018-2019

CHEMISTRY

This report includes course student learning outcome (cSLO) assessment summaries from 2015-16 to 2017-18.

COURSE OFFERINGS

Table 1. Course offerings per academic year from 2015-16 to 2018-19

Course Name	2015-2016	2016-2017	2017-2018	2018-2019
CHEM G110	x	x	x	x
CHEM G110L	x	x	x	x
CHEM G130	x	x	x	x
CHEM G130L	x	x	x	x
CHEM G180	x	x	x	x
CHEM G180L	x	x	x	x
CHEM G185	x	x	x	x
CHEM G185L	x	x	x	x
CHEM G220	x	x	x	x
CHEM G220L	x	x	x	x
CHEM G225	x	x	x	x
CHEM G225L	x	x	x	x

COURSE ASSESSMENT STATUS

Fully Assessed ↑ | Partially Assessed ↔ | No Assessment ↓

Table 2. Course Assessment Status between 2015-16 and 2017-18
*No enrollment data between 2013-14 and 2018-19

Course Name	Total cSLOs	No. cSLOs Assessed	Assessment Status		Last Term Offered
CHEM G110	5	3 out of 5	Partially Assessed	↔	Spring 2019
CHEM G110L	3	3 out of 3	Fully Assessed	↑	Spring 2019
CHEM G130	4	0 out of 4	No Assessment	↓	Spring 2019
CHEM G130L	5	0 out of 5	No Assessment	↓	Spring 2019
CHEM G180	6	3 out of 6	Partially Assessed	↔	Spring 2019
CHEM G180L	3	2 out of 3	Partially Assessed	↔	Spring 2019
CHEM G185	5	1 out of 5	Partially Assessed	↔	Spring 2019
CHEM G185L	3	2 out of 3	Partially Assessed	↔	Spring 2019
CHEM G220	5	3 out of 5	Partially Assessed	↔	Spring 2019
CHEM G220L	4	3 out of 4	Partially Assessed	↔	Spring 2019
CHEM G225	4	3 out of 4	Partially Assessed	↔	Spring 2019
CHEM G225L	3	2 out of 3	Partially Assessed	↔	Spring 2019

Table 3. cSLOs that were not assessed between 2015-16 and 2017-18

Course Name	cSLO Name	cSLO to Assessed
CHEM G110	cSLO 3	Demonstrate inorganic and organic chemistry nomenclature rules.
CHEM G110	cSLO 5	Recall facts about important biomolecules and their biochemical processes.
CHEM G130	cSLO 1	Recognize, apply, and perform mathematical operations using the standard units of scientific measurement and significant figures.
CHEM G130	cSLO 2	Solve mathematical chemistry problems using calculations involving grams, moles, particles of elements and compounds.
CHEM G130	cSLO 3	Use the language, symbols, and nomenclature of inorganic chemistry correctly in chemistry problems and equations.
CHEM G130	cSLO 4	Explain the principles of basic atomic structure, the modern model of the atom, chemical periodicity, the mole, chemical equations, stiochiometry, molecular geometry, solutions, elementary acid/base concepts, and gas laws.
CHEM G130L	cSLO 1	Demonstrate safe laboratory practices through the use of appropriate personal protectiveequipment and appropriate handling of all chemicals, including proper disposal of waste.
CHEM G130L	cSLO 2	Demonstrate a basic understanding and use of laboratory equiment, including the Bunsenburner, top-loading balances, and glassware
CHEM G130L	cSLO 3	Demonstrate introductory skills for laboratory techniques such as measurement, gravity andvacuum filtration, evaporation, and centrifuging.
CHEM G130L	cSLO 4	Write balanced equations from observations of chemical reactions
CHEM G130L	cSLO 5	Record data and observations as well as analyze experimental reslts for accuracy andprecision.
CHEM G180	cSLO 4	Demonstrate the use of typical laboratory equipment and the performance of standard laboratory techniques.
CHEM G180	cSLO 5	Interpret experimental results in terms of pertinent chemical theories.
CHEM G180	cSLO 6	Evaluate the uncertainty associated with experimental results
CHEM G180L	cSLO 2	Interpret experimental results in terms of pertinent chemical theories.
CHEM G185	cSLO 2	Acids and Bases: Students will be able to solve for quantitative aspects of equilibrium: buffers, salts, titrations, solubility.
CHEM G185	cSLO 3	Thermodynamics: Describe the concepts of free energy, enthalpy, and entropy as they relate to chemical reactions, and perform thermodynamic computations.
CHEM G185	cSLO 4	Electrochemistry: Compile REDOX reactions by the half-reaction method, calculate cell potentials, and understand applications in batteries, electroplating, and fuel cells.
CHEM G185	cSLO 5	Nuclear Chemistry: Write and predict nuclear decay reactions, calculate nuclear energy, understand half-life and first order kinetics, discuss nuclear applications and radiation
CHEM G185L	cSLO 2	Use scientific writing to write a lab report.
CHEM G220	cSLO 3	Predict the products, specify the reagents needed with correct stereochemistry and regiochemistry for reactions studied in this semester.
CHEM G220	cSLO 4	Evaluate reactive sites within a molecule by locating them and drawing correct electron-pushing arrows for reactions based on electronic properties and structure instead of rote memorization of mechanisms
CHEM G220L	cSLO 4	Operate in the organic chemistry lab demonstrating good technique, safety practices and notebook keeping.
CHEM G225	cSLO 4	Show how to synthesize a given compound, outlining the forward steps and reagents that are required using reactions learned in this semester.
CHEM G225L	cSLO 2	Perform synthetic transformations in the lab, obtaining purified product in reasonable yield and purity.

DATA EVALUATION

Table 4. cSLOs assessed and corresponding Data Evaluation.
*Denotes historical cSLOs.

Course Name	cSLO	Semester Assessed	cSLO Data Evaluation
CHEM G110	cSLO 1	Spring 2017	Part 1: # Correct (Quiz): 69 % Correct (Quiz): 81% # Correct (Midterm): 69 % Correct (Midterm): 81% Part 2: # Correct (Quiz): 53 % Correct (Quiz): 62% # Correct (Midterm): 67 % Correct (Midterm): 79% Overall Performance (answering both parts correctly): Both parts correct on quiz: 44 (52%) Both parts correct on midterm: 57 (67%) Both parts correct on both quiz/midterm: 35 (40%) Performance increased (quiz to midterm): 23 (26%) Performance decreased (quiz to midterm): 11 (13%) Performance stayed the same but was not 100%: 16 (18%) This same SLO was assessed in Fall 2016 and there were two main goals: 1) increase the number of students getting both parts of the question correct 2) increase retention from the quiz to the midterm The first part of the question assessed mathematical skills, applying data collected in a lab experiment scenario to a mathematical equation to solve for the correct answer.They did this problem-solving technique in one of their lab experiments (Calorimetry) before taking the quiz.They were asked the same question on the Midterm. The second part of the question assesses a qualitative concept where they have to interpret the numerical answer given in part 1.Regardless of if they got the correct answer for Part 1, they were assessed to see if their interpretation of the number was correct as applied to heat being given off or being absorbed by their reaction.Again, they did this same analytical process as part of one of their lab experiments (Calorimetry) before they took the quiz.They were asked the same question on the Midterm. When comparing their success rate to last semester, they did roughly the same on Part 1 of the question in both Fall 2016 and Spring 2017, but they did worse on Part 2 of the question.However, in Fall 2016 the student success rate decreased from the quiz to the midterm, implying a lack of retention.This semester, student success improved from the quiz to the midterm.For Part 1, students got an 81% success rate on both the quiz and the midterm, demonstrating retention (in Fall they decreased by 7%).For Part 2, students obtained a 62% rate on the quiz (which was lower than the Fall, 81%) but they increased their success to 79% on the midterm (a 17% increase).In the Fall, there was a 4% decrease fromthe quiz to the midterm on Part 2, and overall the Fall students did slightly worse on the Midterm than in the Spring (77% vs. 79%) despite doing much better on the quiz (81% vs. 62%). Looking at students getting both parts correct, they increased retention this semester.On the quiz, only 52% of students got both parts correct, which increased to 67% on the midterm (a 15% increase).In the Fall, the students initially did better on this aspect the quiz (72%) but saw a decrease on the midterm (66%, a 6% decrease), ultimately doing slightly worse on the Midterm than the students in the Spring. In terms of overall success, we looked at their success rates on the Midterm as a measure of what was ultimately learned and retained (as opposed to the quiz).Compared to the Fall, there was a higher success rate on both the individual parts of the question (part 1: 81% vs. 74%, part 2: 79% vs. 77%) and an increase in the number of students correctly answering both parts (67% vs. 66%).The results showed a strong increase in retention (especially for Part 2) from the quiz to the midterm whereas last semester there was a decrease on both parts of the question. While the number of students getting both parts correct on both the quiz and the midterm decreased from Fall semester, there was a dramatic increase in the number of students that increased their performance from the quiz to the midterm (26% vs. 17%); in addition the number of students whose

Course Name	cSLO	Semester Assessed	cSLO Data Evaluation
			performance decreased from the quiz to the midterm decreased (13% vs. 25%) and those that retained the same level of performance also increased (18% vs. 6%).These statistics also indicate a strong level of retention.
CHEM G110	cSLO 1*	Fall 2015	There were two questions: 1) What is the pH of a buffer solution in which the [H2CO3] is 0.77 M and the [HCO2-] is 0.31 M?The equilibrium constant, Ka, for H2CO3 is 4.5×10^-7. 2) A 20.00 mL KOH sample of unknown concentration was titrated with 0.6251 M HCl.If 37.62 mL of the HCl solution were required to neutralize the KOH sample, what is the molarity of the KOH sample? Out of 114 students, 101 correctly answered each question (88%). Based on the high percentage, the students seem to understand how to do the calculations related to titrations.The high student success rate is satisfactory.
CHEM G110	cSLO 2	Spring 2018	In this assessment, we defined success as getting the problem 100% correct, but we also kept track of four metrics to see which part of the problem they were struggling with if they got it wrong. While 64% of students assessed got the problem completely correct, the following metrics were met with the following success: 1) Correct # of total electrons (84%) 2) Atoms are arranged correctly (89%) 3) All atoms follow the octet rule (75%) 4) Structure is in brackets with correct charge written (83%) Based on this data, it seems that students had the most trouble with making sure their atoms followed the octet rule.This could lead to them making other errors as well, leading to the incorrect structure. If looking at how many metrics were met (out of 4), students averaged meeting 3.3 out of 4 metrics.This can roughly be correlated with students getting the problem 83% correct (instead of 100% correct). The data was also broken down by lab section and grouped by common lecture instructor: Lecture 61329 Lab Section 1: 61332 (81%) Lab Section 2: 61333 (30%) Lecture 61436 Lab Section 1: 61437 (47%) Lab Section 2: 61438 (68%) Lecture 60593 (86%) Lecture 60908 (69%) There was a large disparity between some of the sections, but those disparities were most noticeable between the two pairs of lab sections that shared a lecture instructor, but had different lab instructors.All students were instructed how to draw Lewis structures during lecture, but were assessed on a worksheet presented during lab.This data implies that perhaps the students are learning more about this topic during lab than they are during lecture.The students may not be learning what was intended from an in-class formative assessment worksheet that was completed just prior to taking the summative quiz assessment used for this SLO.
CHEM G110	cSLO 3*	Spring 2016	Question #1: What is the IUPAC name for the following compound? (it was a branching alkane) Students assessed: 35 Students who answered correctly: 28 % Correct: 80% Question #2: What are the major and minor products of the following reaction and give their names? (it was a hydrobromination of an asymmetric alkene) Students assessed: 35 Students who answered correctly: 24 % Correct: 69% The first question assesses naming skills, and the more than 75% of students assessed answered correctly.Naming is essential to progressing through organic chemistry, as it is the language through which all the more complex aspects of the class are discussed.By this point in the semester, students seem to have a firm grasp of the organic molecule naming.Because more than 75% of the students assessed answered correctly, I consider their knowledge of this topic to be satisfactory. The second question assesses knowledge of a specific chemical process that is similar to processes known to occur in the body.While more than half of the students answered correctly, I would like to see the correct percentage reach 75% or

Course Name	cSLO	Semester Assessed	cSLO Data Evaluation
			above to be considered satisfactory.I would consider the success rate in this topic to be unsatisfactory.
CHEM G110	cSLO 4	Fall 2017	In this assessment, we kept track of two criteria: (1) if the students chose the correct product and (2) if students chose one of the two products that form, but chose the wrong regioisomer (major vs. minor).We also tracked their progress from the quiz to the exam. As a class, there was improvement from the quiz to the exam.Part of this is credited to the final review assignment that was developed in response to previous lecture SLOs.On the quiz, 50% of students answered correctly (with 23% choosing the wrong regioisomer).On the final exam, 67% of students answered correctly (with 24% choosing the wrong regioisomer).On the quiz, 27% of students got it completely wrong, while only 9% got it completely wrong on the final exam.For the goal of this SLO to be considered met, I would like the student success rate on the final exam to reach at least 70%. In addition to overall success on the final exam, it was observed that 35% of students did better on the final than the quiz.51% performed the same, and only 14% of students did worse.These data indicate that students maintained a level of retention, with a significant percentage increasing their performance going into the final. Upon breaking the overall success rates down by section, there was a large disparity: Daytime sections (51117, 51119): Quiz success: 56% Final success: 75% Night sections (50123, 50128): Quiz success: 33% Final success: 44% Both night sections were taught by different instructors, but their success rates were the same.The two daytime sections were taught by the same instructor.Although the demographics tend to differ between the two (daytime sections tend to be more full-time, college-age students and night classes tend to be more working, adult students), the size of this disparity was unexpected. The daytime sections had a chemical reaction extra credit review session during their last lecture before the final exam.This could have contributed to their increased success on this assessment (an increase of 19% from quiz to final, with an overall success rate of 75% on the final).However, this would not have affected their increased success on the initial quiz.Though the night sections also increased from quiz to final, it was less dramatic (only 11%) and their absolute success was low (44% overall success on the final).
CHEM G110	cSLO 4	Spring 2018	In this assessment, we kept track of two criteria: (1) if the students chose the correct product and (2) if students chose one of the two products that form, but chose the wrong regioisomer (major vs. minor).We also tracked their progress from the quiz to the exam. We were interested in improving the success rates relative to Fall 2017, where there was a large disparity between the day and night sections.Our goal was to improve overall success rates to 70%, and this semester we were very close at 69%. Upon breaking the overall success rates down by section, there was a large disparity: Fall 2017: Quiz success: 50% Final success: 67% Spring 2018: Quiz success: 56% Final success: 69% There was less of a disparity on the quiz results; all sections ranged from 50-59% success on the quiz.On the exam, however the daytime sections averaged 75% success while the nighttime sections average 57% success.The daytime sections mostly improved from the quiz to the final exam (from 57% to 75%) while the nighttime sections performed about the same, in fact decreasing in performance (60% down to 57%). Both daytime sections had the same chemical reaction extra credit review session during their last lecture before the final exam.This could have contributed to their increased success on this assessment (an increase of 18% from quiz to final, with an

Course Name	cSLO	Semester Assessed	cSLO Data Evaluation
			overall success rate of 75% on the final).The daytime sections performed almost exactly the same as they did in Fall 2017.In Fall 2017, the nighttime sections showed an increase of 11% from the quiz to the final, where this semester they decreased by 3%.However, their overall performance was higher than in the Fall (57% on the final in Spring 2018 vs. 44% in Fall 2017).Our goal of increasing success in the nighttime sections was successful, but we observed a lack of retention and/or improvement.
CHEM G110	cSLO 5*	Fall 2016	One multiple-choice question was assessed twice.It was assessed once on Quiz 5 and again on the Midterm Exam.The data collected was based on how many students got each question correct.It was a two-part question, and students were assessed base on their answer to each part. Question: When substance X was mixed or dissolved in water to produce X g of solution, the solution temperature increased/decreased from X °C to X °C.If the specific heat of the resulting solution is 1.00 cal/g·°C, what is the heat energy change of the solution?Is this process endo- or exothermic? Part 1 – correct numerical answer Part 2 – endo-/exothermic is consistent with their numerical answer, even if they got Part 1 incorrect Part 1: Students who answered correctly on quiz: 83 % Correct (Quiz): 81% Students who answered correctly on midterm: 75 % Correct (Midterm): 74% Part 2: Students who answered correctly on quiz: 83 % Correct (Quiz): 81% Students who answered correctly on midterm: 79 % Correct (Midterm): 77% Overall Performance (answering both parts correctly): Both parts correct on quiz: 73 (72%) Both parts correct on midterm: 67 (66%) Both parts correct on both quiz/midterm: 53 (52%) Performance increased (quiz to midterm): 17 (17%) Performance decreased (quiz to midterm): 26 (25%) Performance stayed the same but was not 100%: 6 (6%) The first part of the question assessed mathematical skills, applying data collected in a lab experiment scenario to a mathematical equation to solve for the correct answer.They did this problem-solving technique in one of their lab experiments (Calorimetry) before taking the quiz.They were asked the same question on the Midterm. The second part of the question assesses a qualitative concept where they have to interpret the numerical answer given in part 1.Regardless of if they got the correct answer for Part 1, they were assessed to see if their interpretation of the number was correct as applied to heat being given off or being absorbed by their reaction.Again, they did this same analytical process as part of one of their lab experiments (Calorimetry) before they took the quiz.They were asked the same question on the Midterm. Overall the students did well on this assessment; above 80% on the quiz for both parts and above 70% on the midterm for both parts.I consider above 70% to be satisfactory.Performance did decrease from the quiz to the midterm.I was hoping that studying and learning from their mistakes would increase performance, but it seems there was a lack of retention.However, it did not decrease by a significant margin.Students did better on the qualitative aspect than on the quantitative aspect, which was to be expected since the calculation was more difficult and involved than the concept question.I believe the reason for the high success rates have to do with the reinforcement of a calculation and concept by application to a laboratory experiment. Looking at students who succeeded at answering BOTH parts correctly, the success rate dropped to 66% for the midterm, which is just below satisfactory.This is in spite of the fact that they completed it with a satisfactory success rate of 72% on the quiz.

Course Name	cSLO	Semester Assessed	cSLO Data Evaluation
CHEM G110L	cSLO 1	Fall 2017	Based on this assessment, it is clear that students have no problem correlating their collected data to an unknown identification (94% did this part correctly). However, when assessing whether or not they actually identified the correct unknown, the percentage dropped to 76%.The drop is due to the fact that in order to identify the unknown correctly, students also have to be able to perform the melting point lab technique correctly. Students had to watch a melting point lab technique video before starting this lab to give them a visual on how to perform the technique.However, many students were observed to be rushing this technique and thus obtaining the incorrect data (performing this technique too quickly leads to the incorrect data). Students that were able to both correctly identify the unknown and match it to their data was 74%.This success rate is an acceptable amount and we concluded that the students met the criteria laid out in this SLO.Only 4% of the students were unable to complete either objective, and 22% of the students were able to complete 1 of 2 objectives.
CHEM G110L	cSLO 2	Spring 2017	Question: Based on your observations, explain the effect of heat on the solubility of albumin.Your answer should state what the effect was (increased or decreased solubility) and a discussion of protein structure to explain how and why the effect was observed. Part 1 – WHAT: identify that the heat decreases the solubility of albumen Part 2 – HOW: identify that the intermolecular forces holding the 2°/3° structure together are disrupted Part 3 – WHY: identify that coagulation is the reason for observing formation of a solid # Correct Responses on Part 1: 74 (97%) # Correct Responses on Part 2: 41 (54%) # Correct Responses on Part 3: 37 (49%) OVERALL: # of students that got… …all 3 parts correct: 21 (28%) …2 parts correct: 34 (45%) …1 part correct: 21 (28%) …0 parts correct: 0 (0%) We assessed the same question in Fall 2016 and made a simple change to the lab schedule for Spring 2017.We theorized that if we moved the Albumen Denaturation Lab one week later in the schedule (after they had a quiz on the relevant lecture material) that the students would have more time to digest the lecture material on protein structure and thus do better at answering the lab questions in this experiment.We also added a dry lab activity at the beginning of the semester that required students to learn how to properly answer free-response essay-style lab questions. The first part of the question asked a simple “what” question…what did they observe?They had a 50/50 chance of getting it correct, and most of the students (97%) correctly observed that formation of a solid correlates with a decrease in solubility.This was up significantly from Fall 2016 where only 87% got it correct. The second and third parts of the question specified to use what they know about protein structure to explain how the solid formed and why.The mechanism (how) of solid formation is the denaturation process, which in terms of protein structure means the intermolecular forces holding together the 2° and 3° structures was disrupted.While many students mentioned denaturation, roughly half (54%) correctly explained denaturation in terms of protein structure, which is what the question asked.Similarly for the third part which asked why the solid was observed (in terms of protein structure).Again, while many mentioned denaturation, less than half of the students (49%) correlated coagulation as the reason behind the decrease in solubility (since denaturation alone would not form a solid).These numbers are not ideal, but they are up slightly from Fall 2016 (52% and 43%, respectively). It is clear from this assessment that students can correctly identify a decrease or increase in solubility based on a

Course Name	cSLO	Semester Assessed	cSLO Data Evaluation
			lab observation, but they still had trouble correlating the lecture topics about protein structure to what they were observing in the lab.If we state that the minimum for success would be answering at least 2/3 parts correctly, then 73% of the students assessed were successfully able to explain these topics.This was a dramatic increase from Fall 2016, where only 58% of the students were deemed to have successfully completed this assessment.The percentage of students able to get all 3 parts correct remained the same as Fall 2016 (28%).In addition, NO students (0%) got 0/3 parts correct; in Fall 2016, 5% of the students assessed got 0/3 for the question.Last semester we stated that if we were able to get the success rate over 70% then that would be a success, and this semester we obtained a 73% success rate.Overall, the students were found to be successful at correlating the relevant lecture topic to the lab observations.
CHEM G110L	cSLO 3	Spring 2018	In this assessment, we defined success as getting the problem 100% correct, but we also kept track of four metrics to see which part of the problem they were struggling with if they got it wrong. While 40% of students assessed got the problem completely correct, the following metrics were met with the following success: 1) Read in the correct direction (80%) 2) Correct significant digits (61%) 3) Correct units recorded (100%) 4) Measurement is within +/- of the true value (57%) Based on this data, it seems that students had the most trouble with both assessing the correct number of significant digits and in getting it accurate enough to the true value.This was following the students being instructed to watch a video on the course website to instruct on how to read a buret. If looking at how many metrics were met (out of 4), students averaged meeting 3.0 out of 4 metrics.This can roughly be correlated with students getting the problem 74% correct (instead of 100% correct). The data was also broken down by lab section, but there was no significant difference in the averages per lab section.They were all within the standard deviation of the average. The students may need an additional buret volume problem in their workbook, as they are only presented with examples on rulers and graduated cylinders.
CHEM G110L	cSLO 5*	Fall 2016	One free response question was assessed on the Albumin Denaturation Lab.It was a three-part question, and students were assessed base on whether or not they correctly identified the explanation to each part of the question. Question: Based on your observations, explain the effect of heat on the solubility of albumin.Your answer should state what the effect was (increased or decreased solubility) and a discussion of protein structure to explain how and why the effect was observed. Part 1 – WHAT: identify that the heat decreases the solubility of albumin Part 2 – HOW: identify that the intermolecular forces holding the 2°/3° structure together are disrupted Part 3 – WHY: identify that coagulation is the reason for observing formation of a solid # of students answering each part correctly: Part 1: 71 (87%) Part 2: 43 (52%) Part 3: 35 (43%) OVERALL: # of students that got… …all 3 parts correct: 23 (28%) …2 parts correct: 25 (30%) …1 part correct: 30 (37%) …0 parts correct: 4 (5%) The first part of the question asked a simple “what” question…what did they observe?They had a 50/50 chance of getting it correct, and most of the students (87%) correctly observed that formation of a solid correlates with a decrease in solubility. The second and third parts of the question specified to use what they know about protein structure to explain how the solid formed and why.The mechanism (how) of solid formation is the denaturation process, which in terms of protein structure

Course Name	cSLO	Semester Assessed	cSLO Data Evaluation
			means the intermolecular forces holding together the 2° and 3° structures was disrupted.While many students mentioned denaturation, roughly half (52%) correctly explained denaturation in terms of protein structure, which is what the question asked.Similarly for the third part which asked why the solid was observed (in terms of protein structure).Again, while many mentioned denaturation, less than half of the students (43%) correlated coagulation as the reason behind the decrease in solubility (since denaturation alone would not form a solid). It is clear from this assessment that students can correctly identify a decrease or increase in solubility based on a lab observation, but they had trouble correlating the lecture topics about protein structure to what they were observing in the lab.If we say that answering this question with a 75% or above (meaning they got 2/3 parts correct or more), then only 58% of the students assessed were successfully able to explain these topics.To demonstrate satisfactory ability to correlate lecture topics to the lab questions, the success rate should be 70% at a minimum.Overall, the students were not successful at correlating the relevant lecture topic to the lab observations. A reason for the low success rate could be that the lab was performed immediately following the lecture given on this topic.Perhaps doing this lab a week later, after the students had been given a chance to do their homework and study this topic, they would be better at applying these topics to the lab.A second reason could be that students at this level of class are generally unprepared for answering analytical essay-style questions.
CHEM G130	cSLO 1*	Summer 2017	An important skill set for chemistry students is to be able to break down a reaction both qualitatively and quantitatively.Students were assessed during the final example to interpret a word problem involving a metathesis reaction of two compounds and organize the information to answer specific questions.The question informed students that barium sulfate reacted with iron (III) sulfate to form a solid; in addition, concentrations and volumes were also provided for the reactants.Students were then asked a series of questions pertaining to this reaction.When asked to write down the reaction, identify the solid, and balance the chemical reaction, only 11of 15students were able to successfully do so with the remaining student missing the point of the question.Additionally, these 11 students were able to identify both spectator ions and 10were able to draw a diagram representing such a solutionincluding all relevant components.Lastly, when it came to evaluating students' ability to quantitatively analyze the problem, 9of 12 students were able to successfully identify the correct limiting reagent and proceed to calculate the proper theoretical and, subsequently, the percent yield.The goal was to determine whether the students were able to successfully implement the core concepts involved in solutions chemistry.Unfortunately, despite being a smaller class, this semester's students were not as collaborative as last semester, despite ample opportunities to communicate with one another.The question required students to draw from multiple concepts learned throughout the semester.73% of the students successfully converted the each name of the compound to its proper molecular formula and proceed to balance the equation.Of these, all of them were able to apply solubility rules to identify the solid precipitate that would form.In addition, all of these students also were able to determine the spectator ions and their roles in a solution.91% of these students can also correlate this theoretically posed scenario with a real world laboratory conditions.Quantitatively, 60% of the students recognized that the problem was one that required them to identify a limiting reagent.While all of these studentssuccessfully identified the

Course Name	cSLO	Semester Assessed	cSLO Data Evaluation
			correct limiting reagent, mostof them were able to properly organize the numbers and apply stoichiometric concepts to arrive at a reasonable theoretical yield.
CHEM G130	cSLO 2*	Fall 2016	A key concept covered in Chemistry 130, which carries into future chemistry courses (both lecture and laboratory) is write a chemical equation for the dissociation of soluble salts.This problem covers multiple concepts covered throughout the semester. 1.Students are given a written name for the salt and have to write the chemical formula.(Chapter 4) 2.Students must have knowledge of the solubility rules.(Chapter 5) 3.Students must understand the concept that soluble salts dissociate into respective ions (Chapter 5 and Chapter 12) 4.Students must know how to write a balanced chemical equation with states (Chapter 5 and Chapter 12) The topic is initially covered in Chapter 5 and then reintroduced in Chapter 12.This allows students who did not initially understand the concept to gain an understanding of the topic. An assessment was completed using the following question on Exam V:"Write an equation for the dissociation of potassium carbonate in water". The results were tabulated as follows: A - Students wrote the correct formula for potassium carbonate B- Students identified soluble salts dissociated into ions C - Students wrote the correct balanced equation for the dissociation of salt The results for the Monday-Wednesday daytime section: A - 42 out of 54 students wrote the correct formula for potassium carbonate corresponding to 78% B - 46 out of 54 students identified soluble salts dissociated into ions corresponding to 85% C - 41 of out 54 students wrote the correct balanced equation for the dissociation of salt corresponding to 76% To analyze the results as a whole of the outcome: 36 out of 54 students got all three outcomes correct, corresponding to 66.6% 8 out of 54 students got two outcomes correct, corresponding to 14.8% 5 out of 54 students got one outcome correct, corresponding to 9.3% 5 out of 54 students got zero outcomes correct, corresponding to 9.3% The results for the Tuesday-Thursday evening section A - 16 out of 19 students wrote the correct formula for potassium carbonate corresponding to 84% B - 17 out of 19 students identified soluble salts dissociated into ions corresponding to 89% C - 14 of out 19 students wrote the correct balanced equation for the dissociation of salt corresponding to 74% To analyze the results as a whole of the outcome: 14 out of 19 students got all three outcomes correct, corresponding to 74.0% 2 out of 19 students got two outcomes correct, corresponding to 10.5% 1 out of 19 students got one outcome correct, corresponding to 5.0% 2 out of 19 students got zero outcomes correct, corresponding to 10.5% Overall, the evening section had a greater percentage of students performing each individual outcome successfully, as well as the total outcome more successfully. In the daytime section, 42 out of 54 students were able to write the correct formula for potassium carbonate.This is lower that what the instructor would like. This concept is covered in week 4 of the semester where the lecture size is approximately 75.Many students get lost at this part in the course and struggle through the remaining of the semester because Chapter 4 is a foundation chapter for the remaining of the course.In comparison, the evening instructor has approximately 25 students.The instructor has a greater flexibility to help more students individually. In looking at the assessment numbers, students who were not able to write the correct formula for potassium carbonate (outcome A), could also not write a correct balanced equation (outcome B).Not understanding the basic concept of the formula makes it difficult for

Course Name	cSLO	Semester Assessed	cSLO Data Evaluation
			students to grasp concepts where understanding the formula is needed. In both the daytime and evening sections, 85% and 89%, respectively, were able to understand and recognize that a salt does dissociate into ions.This is the most difficult concept of the three assessed.
CHEM G130	cSLO 2*	Spring 2017	A key concept covered in Chemistry 130, which carries into future chemistry courses (both lecture and laboratory) is write a chemical equation for the dissociation of soluble salts.This problem covers multiple concepts covered throughout the semester. 1.Students are given a written name for the salt and have to write the chemical formula.(Chapter 4) 2.Students must have knowledge of the solubility rules.(Chapter 5) 3.Students must understand the concept that soluble salts dissociate into respective ions (Chapter 5 and Chapter 12) 4.Students must know how to write a balanced chemical equation with states (Chapter 5 and Chapter 12) The topic is initially covered in Chapter 5 and then reintroduced in Chapter 12.This allows students who did not initially understand the concept to gain an understanding of the topic. An assessment was completed using the following question on Exam V:"Write an equation for the dissociation of potassium carbonate in water". The results were tabulated as follows: A - Students wrote the correct formula for potassium carbonate B- Students identified soluble salts dissociated into ions C - Students wrote the correct balanced equation for the dissociation of salt The results for the Monday-Wednesday daytime section: A - 48 out of 54 students wrote the correct formula for potassium carbonate corresponding to 89% B - 49 out of 54 students identified soluble salts dissociated into ions corresponding to 91% C - 49 of out 54 students wrote the correct balanced equation for the dissociation of salt corresponding to 91% To analyze the results as a whole of the outcome: 45 out of 54 students got all three outcomes correct, corresponding to 83.3% 4 out of 54 students got two outcomes correct, corresponding to 7.4% 3 out of 54 students got one outcome correct, corresponding to 5.6% 2 out of 54 students got zero outcomes correct, corresponding to 3.7% The results for the Tuesday-Thursday evening section A - 16 out of 24 students wrote the correct formula for potassium carbonate corresponding to 67% B - 18 out of 24 students identified soluble salts dissociated into ions corresponding to 75%% C - 13 of out 24 students wrote the correct balanced equation for the dissociation of salt corresponding to 64% To analyze the results as a whole of the outcome: 13 out of 24 students got all three outcomes correct, corresponding to 54.2% 2 out of 24 students got two outcomes correct, corresponding to 8.3% 6 out of 24 students got one outcome correct, corresponding to 25.0% 3 out of 24 students got zero outcomes correct, corresponding to 12.5% Overall, the daytime section had a greater percentage of students performing each individual outcome successfully, as well as the total outcome more successfully. In the daytime section, 48 out of 54 students (89%) were able to write the correct formula for potassium carbonate.This is much greater over the Fall 2016 semester where only 77% of students were able to write the correct formula. Additionally, concepts B and C student success percentages went up dramatically from Fa 2016. Fall 2016 - Concept B = 85% answered correctly and Concept C = 76% answered correctly Spring 2017 - Concept B = 91% answered correctly and Concept C = 91% answered correctly This improvement is due to changes I willdiscuss in the assessment section. However, the assessment results decreased for the Tuesday-Thursday section. 16 out of 24 students (67%) were able to write the correct formula for potassium carbonate.This is much lower the Fall 2016

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			semester where 84% of students were able to write the correct formula. Additionally, concepts B and C student success percentages went down from Fa 2016. Fall 2016 - Concept B = 89% answered correctly and Concept C = 74% answered correctly Spring 2017 - Concept B = 75% answered correctly and Concept C = 54% answered correc
CHEM G130L	cSLO 2*	Spring 2016	Below is the summary of the data evaluation. See attached document or Document Repository for full 5SM assessment result. For the daytime section: (a) Student assessment increased (from quiz to exam) from 90% to 100% (b) Student assessment increased (from quiz to exam) from 70% to 95% (c) Student assessment increased (from quiz to exam) from 8% to 48% For the evening section: (a) Student assessment increased (from quiz to exam) from 70% to 90% (b) Student assessment increased (from quiz to exam) from 80% to 90% (c) Student assessment remained at 100% Assessing the data between the daytime and evening section, there is a large discrepancy in part c.I spoke with the evening instructor regarding this and the instructor stated that he marked the answer as correct if the students put “wants to be like a noble gas”- while the daytime instructor did not.Although the assessment was discussed ahead of time, there was a lack of understanding on how to grade part c.If the daytime instructor had given credit for this answer, the number of students who got part c correct would have been much greater.
CHEM G130L	cSLO 4*	Fall 2016	In the first laboratory for the course, students are taught how to appropriately record measurements from glassware.Students are taught to record one digit (past the scale) or to include an estimated digit.During the first part of the semester, students use this skill often.Due to the nature of the material, students do not measure as much in the mid-part of the semester, but then use the skill towards the end of the semester.Students need to use this skill on the Titration of Acetic Acid experiment.Students were not told ahead of time I would specifically be grading them on this skill.The results were as follows: The daytime sections of Chemistry 130 Laboratory (50470; 50118; 50132): 54 students were assessed and 54 students recorded an uncertain digit. The evening section of Chemistry 130 Laboratory (50469): 18 students were assessed and 16 students recorded an uncertain digit. In total, 70 out of 72 students recorded an uncertain digit.This correspond to 97% of students being able to apply what they learned at the beginning to the semester to the end of the semester.
CHEM G130L	cSLO 4*	Spring 2017	In the first laboratory for the course, students are taught how to appropriately record measurements from glassware.Students are taught to record one digit (past the scale) or to include an estimated digit.During the first part of the semester, students use this skill often.Due to the nature of the material, students do not measure as much in the mid-part of the semester, but then use the skill towards the end of the semester.Students need to use this skill on the laboratory practicum.Students were not told ahead of time I would specifically be grading them on this skill.The results were as follows: For theMonday-Wednesday laboratory sections, 53 students were assessed and 50 students recorded an estimated digit as well as determined the uncertainty correctly.This corresponds 94% of the assessed students recording data correctly. For the Tuesday-Thursday laboratory sections, 24 studentswere assessed and 22students recorded an estimated digit as well as determined the uncertainty correctly.This corresponds 92% of the assessed students recording data correctly.

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CHEM G130L	cSLO 5*	Summer 2017	Chem 130L SLOAssessment -Summer 2017Step4Describe and analyze the data from Step 3 (above).It is important to bridge the gap between the theories taught in class and their practical applications in a laboratory setting.One of the more important skill set is the ability to make a solution at a specified concentration from scratch.Students were asked to make a 100.0 mL of 0.4024 M potassium chloride solution and describe, in detail, the order of steps in which to make it.13of 15students successfully calculated the mass of potassium chloride required to make the 100.0 mL solution.However,11of the 13students were able to make the solution properly, as follows: 1) weigh out 3.000 g of KCl, 2) fully dissolve the salt in a volumetric flask using a small amount dI water, and 3) fill the flask to 100.0 mL, add stopper and invert mix.Of the students that missed this question, 2 opted to use a beaker to dissolve the salt instead of a volumetric flask, and both ofthem chose to dissolve the solid in the full 100.0 mL of water from the start.While this is not entirely incorrect in terms of reasonably making a solution, it does miss the mark in terms of the selection of a volumetric container, specifically one with a muchgreater level of uncertainty.The ability to make a working solution for experiments forms the foundation of most scientific experiments.The goal of the question was two tiered.First, it determines whether students can recognize that the starting point of making any solution is to determine how much of the solute of interest is required initially.87% of the students successfully calculated that 3.000 grams of KCl needed to be weighed.The second part determines whether students understand the rationale of making a solution in a volumetric flask.In this case, students had to realize that filling a volumetric flask completely will remove void space to encourage mixing thereby extending the dissolution time substantially.Fortunately, 85% of thesestudents recognized this distinction.Of the remaining students that missed this, 50% of them knew they needed to add to 100.0 mL mark, but choose the wrong volumetric container.
CHEM G180	cSLO 1	Spring 2017	Students that incorrectly answered two or fewer of the eight parts of the Exam I question regarding isotope symbols were considered proficient at writing and extracting information from isotope symbols.The students that incorrectly answered two or fewer of the eight parts of the Exam I question are those students not in the fourth column, which is 212 – 46 = 166.The percentage of students that meet this criterion is 78.3% (166/212).Since the percentage of students that meet this criterion is greater than 70%, overall, CHEM G180 students are considered to be proficient at writing and extracting information from isotope symbols.These data indicate that the part of the question most often answered incorrectly by students was the part that asked students to write an isotope symbol.
CHEM G180	cSLO 2	Fall 2017	The assessment results follow.The correct answer is indicated with green font. 1. Which aqueous solution has the highest freezing point? Answer Option Number (Percentage) of Students That Chose the Answer Option (a) 1.0 m glucose 7 (16.7%) (b) 1.0 m NaCl 3 (7.1%) (c) 1.0 m Ca(NO3)2 4 (9.5%) (d) 1.0 m (NH4)3PO4 28 (66.7%) Only 16.7% of students correctly answered the question, indicating a low level of success. The most frequently chosen answer was 1.0 m (NH4)3PO4.This is the solution with the greatest concentration of solute particles in solution.This is the solution that experiences the greatest freezing point depression, and so has the lowest freezing point.Students that chose this answer likely realized that 1.0 m (NH4)3PO4 has the greatest concentration of solute particles in solution and

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			so experiences the greatest freezing point depression, but missed the nuance that greater freezing point depression leads to a lower freezing point, not a higher freezing point.These students understood almost all of the concepts necessary to correctly answer the question. The most concerning data are the seven students who chose 1.0 m NaCl or 1.0 m Ca(NO3)2.Choosing either of these answers suggests multiple student misconceptions.
CHEM G180	cSLO 3	Fall 2016	Four CHEM G180 sections were taught this term.Sections 50130 and 50133 were taught by one instructor.Section 50136 was taught by a second instructor.Section 51168 was taught by a third instructor.The assessment results for these sections follow. Section Ratio (Percentage) of Students That Chose the Correct Solvent Ratio (Percentage) of Students That Chose the Correct Solvent and Correctly Explained Their Choice 50130 30/36 (83.3%) 27/36 (75.0%) 50133 36/41 (87.8%) 33/41 (80.5%) 50136 34/43 (79.1%) 20/43 (46.5%) Average Percentage Correct 51168 66.7 Different instructors reported the assessment data in different ways.Two instructors reported the data in two parts:(a) the number of students that chose the correct solvent (the correct answer) and (b) the number of students that chose the correct solvent and provided a correct explanation for their choice.Students taught by both of these instructors were proficient at choosing the correct solvent, at determining the relative solubilities of compounds.However, students were less proficient at explaining their choice of solvent, at explaining the relative solubilities of compounds.It is unsurprising that students would have more difficulty explaining their choice of solvent.Explaining an answer is routinely more difficult than providing an answer.Students taught by one of these instructors (those in sections 50130 and 50133) were significantly better at explaining their choice of solvent than those students in the other section (50136). The third instructor (51168) reported the assessment data as an average percentage correct.The average percentage correct is the average number of points earned on the assessment question by students.For example, if the class consisted of four students, the exam question was worth 4 points, and the four students earned scores of 2, 4, 2, and 1 point.The average percentage correct would be [(2+4+2+1)/(4+4+4+4)]x100 = 56.3%.Since the assessment data was reported as an average percentage correct, the number of students in this section who were proficient at explaining their choice of solvent is uncertain. The reason students in sections 50130 and 50133 were significantly better at explaining their choice of solvent than students in section 50136 might be due to a difference in the way the question was asked by the two instructors.The instructor of sections 50130 and 50133 broke the overall question into many subquestions.E.g., the overall question, In which solvent is ammonia more likely to be soluble, methanol or carbon disulfide? was broken in the subquestions: (a) Is ammonia considered to be polar or nonpolar?Justify your answer. (b) What is the strongest interparticle force in a pure sample of methanol?Is methanol considered to be polar or nonpolar?Justify both your answers. (c) What is the strongest interparticle force in a pure sample of carbon disulfide?Is carbon disulfide considered to be polar or nonpolar?Justify both your answers. (d) In which solvent is ammonia more likely to be soluble, methanol or carbon disulfide?Explain your answer. (e) What is the strongest interparticle force attracting ammonia to your answer to part (d)?Justify your answer.
CHEM G180	cSLO 3*	Fall 2015	Three CHEM G180 sections were taught this term.Sections 54466 and 54469 were taught by one instructor.Section 54479 was taught by a second

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			instructor. The assessment results for these three sections follow. Section Students Who Correctly Determined the Empirical Formula of the Compound 54466 41/67 (61.19%) 54469 42/70 (60.00%) 54479 19/51 (37.25%) Our benchmark for a satisfactory level of accomplishment is 70% of students correctly determining the empirical formula of a chemical compound from combustion analysis data.Neither CHEM G180 as a whole nor any of the individual lab sections achieved a satisfactory level of accomplishment. Determining the empirical formula of a chemical compound from combustion analysis data requires performing several calculations.The calculations to be performed follow a standard procedure.Data on which step in the procedure is the one where the initial mistake occurred were also collected.The assessment results for the three sections follow. Step of the Procedure to Determine the Empirical Formula of a Compound From Combustion Analysis Data Section Students That Made Their Initial Mistake at This Step of the Procedure 1. Convert grams of CO2 to grams of C. (a) The student made a mistake while trying to perform the first step of the procedure. 54466 1/26 (3.85%) 54469 3/28 (10.71%) 54479 2/32 (6.25%) 1. Convert grams of CO2 to grams of C. (b) The student didn't know what the first step of the procedure was. 54466 9/26 (34.62%) 54469 7/28 (25.00%) 54479 15/32 (46.88%) 2. Convert grams of H2O to grams of H. 54466 2/26 (7.69%) 54469 2/28 (7.14%) 54479 4/32 (12.50%) 3. Check for the presence of oxygen. 54466 4/26 (15.38%) 54469 6/28 (21.43%) 54479 3/32 (9.38%) 4. Convert grams of each element to moles. 54466 2/26 (7.69%) 54469 8/28 (28.57%) 54479 4/32 (12.50%) 5. Write a formula for the compound using the mole amounts as subscripts.Divide each subscript by the smaller of the two mole amounts.If necessary, multiply each subscript by a small integer to achieve whole numbers. 54466 8/26 (30.77%) 54469 2/28 (7.14%) 54479 4/32 (12.50%) Most CHEM G180 students made their initial mistake in the procedure to determine the empirical formula of a compound from combustion analysis data during the first step.Moreover, nearly all of these students were unable to begin the procedure; they didn't actually know the first step of the procedure.
CHEM G180L	cSLO 1	Spring 2018	Ten CHEM G180L sections were taught this term.Section 60551 was taught by one instructor.Sections 61157 and 60556 were taught by a second instructor.Section 61543 was taught by a third instructor.Section 60550 was taught by a fourth instructor.Sections 61565 and 60557 were taught by a fifth instructor.Section 60552 was taught by a sixth instructor. Sections 60553 and 61300 were taught by a seventh instructor.The results for these ten sections follow. Section Ratio (Percentage) of Students That Measured the Volume to the Correct Number of Significant Figures Ratio (Percentage) of Students That Reported the Volume With the Correct Units 60551 17/23 (73.9%) 23/23 (100.0%) 61157 22/23 (95.6%) 23/23 (100.0%) 60556 14/20 (70.0%) 20/20 (100.0%) 61543 18/25 (72.0%) 24/25 (96.0%) 60550 19/26 (73.1%) 26/26 (100.0%) 61565 23/25 (92.0%) 21/25 (84.0%) 60557 26/27 (96.3%) 27/27 (100.0%) 60552 28/29 (96.6%) 28/29 (96.6%) 60553 23/28 (82.1%) 26/28 (92.9%) 61300 12/22 (54.5%) 22/22 (100.0%) All sections 202/248 (81.5%) 240/248 (96.8%) Students were more successful at reporting the units of volume than its value to the correct number of significant figures.This is not a surprise.Reporting the units of volume is largely a matter of remembering to do so.Recording volume to the correct number of significant figures is a learned skill. Even though students were less successful at recording volume to the correct number of significant figures, they were still highly proficient at

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			doing so, having an overall success rate of 81.4%. Section 61300 had a much lower success rate than that of other sections for the recording of volume to the correct number of significant figures.
CHEM G180L	cSLO 3	Summer 2017	Three CHEM G180L sections were taught this term.Section 45937 was taught by one instructor.Section 45985was taught by a second instructor.Section 45938was taught by a third instructor.The results for these three sections follow. SectionRatio (Percentage) of Students That Correctly Calculated the Relative Average Deviation 45937 14/16 (87.5%) 4598515/15 (100.0%) 45938 13/16 (81.3%) All sections42/47 (89.4%) Students in all three lab sections were highly proficient at calculating the relative average deviation in their experimental results for the Gravimetric Determination of Sulfate experiment.Instructors noticed that several students failed to submit the lab report for this lab experiment.Those students were not included in the above dat
CHEM G180L	cSLO 4*	Fall 2015	Eight CHEM G180L sections were taught this term.Sections 56040 and 56041 were taught by one instructor.Sections 54480 and 58798 were taught by a second instructor.Sections 54481 and 54482 were taught by a third instructor.Section 58919 was taught by a fourth instructor.Section 56042 was taught by a fifth instructor.The results for these eight sections follow. Were the Bunsen Burner Flames Properly Adjusted? Were the Bunsen Burner Flames Correctly Positioned? 56040 16 students earned 3/3 (80.00%) 1 student earned 2/3 (5.00%) 2 students earned 1/3 (10.00%) 1 student earned 0/3 (5.00%) 56041 20 students earned 3/3 (86.96%) 3 students earned 2/3 (13.04%) 0 students earned 1/3 (0.00%) 0 students earned 0/3 (0.00%) 54480 12 students earned 3/3 (52.17%) 10 students earned 2/3 (43.48%) 1 student earned 1/3 (4.35%) 0 students earned 0/3 (0.00%) 58798 13 students earned 3/3 (61.90%) 7 students earned 2/3 (33.33%) 1 student earned 1/3 (4.76%) 0 students earned 0/3 (0.00%) 54481 23 students earned 3/3 (100.0%) 0 students earned 2/3 (0.00%) 0 students earned 1/3 (0.00%) 0 students earned 0/3 (0.00%) 54482 21 students earned 3/3 (91.30%) 2 students earned 2/3 (8.70%) 0 students earned 1/3 (0.00%) 0 students earned 0/3 (0.00%) 58919 15 students earned 3/3 (62.50%) 9 students earned 2/3 (37.50%) 0 students earned 1/3 (0.00%) 0 students earned 0/3 (0.00%) 56042 23 students earned 1/1 (88.46%) 3 students earned 30/1 (11.54%) Were the Bunsen Burner Flames Correctly Positioned? 56040 14 students earned 3/3 (70.00%) 1 student earned 2/3 (5.00%) 3 students earned 1/3 (15.00%) 2 students earned 0/3 (10.00%) 56041 18 students earned 3/3 (78.26%) 3 students earned 2/3 (13.04%) 1 student earned 1/3 (4.35%) 1 student earned 0/3 (4.35%) 54480 15 students earned 3/3 (65.22%) 8 students earned 2/3 (34.78%) 0 students earned 1/3 (0.00%) 0 students earned 0/3 (0.00%) 58798 10 students earned 3/3 (47.62%) 11 students earned 2/3 (52.38%) 0 students earned 1/3 (0.00%) 0 students earned 0/3 (0.00%) 54481 23 students earned 3/3 (100.0%) 0 students earned 2/3 (0.00%) 0 students earned 1/3 (0.00%) 0 students earned 0/3 (0.00%) 54482 21 students earned 3/3 (91.30%) 2 students earned 2/3 (8.70%) 0 students earned 1/3 (0.00%) 0 students earned 0/3 (0.00%) 58919 21 students earned 3/3 (87.50%) 3 students earned 2/3 (12.50%) 0 students earned 1/3 (0.00%) 0 students earned 0/3 (0.00%) 56042 22 students earned 1/1 (84.62%) 4 students earned 0/1 (15.38%) Students in four of the eight lab sections (56040, 56041, 54481, and 54482) were highly proficient at properly adjusting their Bunsen burner flames.Seventy or more percent of students in these sections properly adjusted all three of their

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			Bunsen burner flames. Students in one of the eight lab sections (56042) were highly proficient at properly adjusting their Bunsen burner flames.Seventy or more percent of students in these sections properly adjusted their single Bunsen burner flame. Students in the remaining three lab sections (54480, 58798, and 58919) were relatively proficient at properly adjusting their Bunsen burner flames.Fifty or more percent of students in these sections properly adjusted all three of their Bunsen burner flames.Ninety or more percent of the students in these sections properly adjusted two or more of their three Bunsen burners. With the exception of two sections (54480 and 58919), students were less proficient at correctly positioning their Bunsen burner flames than they were are properly adjusting their Bunsen burner flames.This isn't surprising.Correctly positioning the Bunsen burner flame is dependent on the Bunsen burner flame being properly adjusted.If the Bunsen burner flame is improperly adjusted, it likely lacks a well-defined inner cone, and if the Bunsen burner flame
CHEM G185	cSLO 1	Spring 2017	38 students in the MW evening class were assessed on a rate expression problem assessingrelative rates of reaction.78% answered the question correctly. 48 students in the TTH morning class were assessed on determining the rate law of a reaction from experimental data.80% answered the question correctly
CHEM G185	cSLO 3*	Spring 2018	98 students were assessed. The results are pooled between the night and day classes. There was no significant difference between the night vs day student results. 16 students answered incorrectly.82 students answered correctly. This was a conceptual acid-base buffer question on the final, involving interpretation of quantitative data to solve correctly.85% of the class was able to solve this in depth question, even under time-constraints.
CHEM G185	cSLO 4*	Summer 2017	Assessment 1: ALEKS is designed as a learning tool that reinforces proficiency before allowing students to progress to the next topic. Each student was asked 4 questions on this topic which required them to correctly identify and balance a REDOX half-reaction. These half-reactions were added together in an acidic or basic environment then re-balanced to achieve an overall balanced REDOX reaction. Students were required to complete this assignment (with 100% proficiency) before their evaluation on Exam III (Assessment 2). Assessment 2 Exam III:In a Free Response type question students were given a disproportionation REDOX equation on Exam III that was to be balanced in an acidic solution.This challenge required students to (Q1) correctly identify and balance each half-reaction and label as oxidation or reduction. (Q2) Add the two half-reactions together and re-balance to create an overall balanced REDOX reaction. Q1–24 out of 32 students (75%) could correctly identify and balance each half-reaction. Q2 – 24 out of 32 students (75%) could successfully create an overall balanced REDOX reaction.Assessment 3 Final Exam: On a Multiple Choice type question, students were given a disproportionation REDOX equation on the Final Exam that was to be balanced in a basic solution. This challenge required students to (Q3) correctly identify and balance each half-reaction label as oxidation or reduction. (Q4) Add the two half-reactions together and re-balance to create an overall balanced REDOX reaction.Q3 – 28 out of 32 students (87.5%) could correctly identify and balance each half-reaction. Q4 - 28 out of 32 students (87.5%) could successfully create an overall balanced REDOX reaction. Taking a success rate of 70% to be proficient, Overall, CHEMISTRY 185 students were proficient in the compilation of REDOX reaction by the half-reaction method

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CHEM G185L	cSLO 1	Spring 2017	The students were asked to identify cations in an unknown solution. 41% correctly identified all 11 cations, 28% missed one cation, 23% missed 2 cations, 8% missed 3 cations.
CHEM G185L	cSLO 3	Spring 2018	98 students were assessed. The results are pooled between the night and day classes. There was no significant difference between the night vs day student results. 96 students stated that they showed great improvement in writing lab notebook procedures Students stated that writing the lab procedure helped them understand the lab better, made them more productive during lab time, and they were able to adjust the writing to their own preferred style.2 students felt that writing the lab procedure ahead of time did not help them.
CHEM G220	cSLO 1	Fall 2017	On the final exam, three complex compounds with several functional groups and stereochemical sites were to be named. A total of 15 points (our of 200 for the entire exam) were allocated to this question. A score of 10 or more was considered successful. 33 students (65%) achieved this score. Another 12 (24%), scored 8 or 9 points. Most students missed points for R/S and E/Z stereochemistry, with many forgetting to add some or all of these to their names. The other major point missed by many students was using the most important functional group (amine in the question this time) as the suffix for their name.
CHEM G220	cSLO 1*	Fall 2016	The students were asked to draw three different compounds of specific stereochemistry and/or conformation using standard types of drawings. 42 students were successful in drawing the correct compounds using wedge/dash drawings, 29 students were successful when drawing a Fischer projection and 39 students were successful in drawing the correct chair conformation of the desired compound. They get much more practice drawing wedge/dash depictions than they do with Fischer projections, which are less common, so this is not unexpected.
CHEM G220	cSLO 2	Spring 2018	In this assessment, we defined success as getting the problem 100% correct, but we also kept track of three metrics to see which part of the problem they were struggling with if they got it wrong. While 70% of students assessed got the problem completely correct on the Midterm, the following metrics were met with the following success: 1) Correctly drawn chair conformer -Quiz – 73% -Midterm – 95% -Final – 73% 2) Consistent chair-flip conformer -Quiz- 68% -Midterm – 80% -Final – 75% 3) Identification of the most stable of the two conformers -Quiz – 70% -Midterm – 83% -Final – 68% TOTAL Success Rates (students getting all three metrics correct: Quiz- 53% Midterm- 70% Final- 33% Based on this data, it is apparent that student did the best on the this assessment on the Midterm, after having received feedback on a quiz.This topic was covered early in the semester, and led to lower retention into the Final Exam.In addition, the Final Exam was cumulative and a much more difficult exam than the Midterm Exam, which covered less material. However, if breaking down the data by success on individual metrics, students did about as well on the Final Exam as they did on the first Quiz.While the number of students able to get the problem 100% correct diminished significantly, a larger number of students was able to get it mostly right on the Final Exam when compared to the quiz.However, both are much lower when compared to the Midterm exam, where students did very well.The biggest issue on the Final Exam seemed to be that students were unable to identify the more stable conformer even though they had drawn their chair conformers perfectly.A table of 1,3-diaxial energies was provided to assist

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			them with this task, but many of them were still unable to identify the correct conformer, leading to the decrease in total success on the problem. In summary, students did fairly well on this assessment, but it is apparent that they did not retain the information going into the Final Exam.
CHEM G220	cSLO 5	Spring 2017	A lower score can be expected, as this is a totally new concept for them.Synthesis problems are the most difficult type encountered in organic chemistry, requiring students to know a large number of reactions and to combine them together to synthesize a complex molecule. This requires excellent critical thinking skills and usually only the A and B students in a class can do this. On these questions this semester, three students answered the questions at a level of 90% or above, two students earned 80%-85% and 1 student earned 67%. I consider these students (38% of the class) to have successfully accomplished this SLO.2 students earned 38-42%. Other 6 students earned 8- 29% points.
CHEM G220L	cSLO 1	Fall 2017	Two skills were assessed in Fall 2017 - using extraction to determine whether an unknown mixture of two compounds contained acidic, basic, or neutral compounds and thin layer chromatography to determine the Rf for two compounds, decide whether they are the same or different, and if different, which is more polar. Only 25 students scored at least 70% of the points on the extraction question, despite the fact that these same compounds were studied for their acid/base behavior in two different experiments during the semester and that extraction was used extensively in other experiments. This is the first time this skill has been assessed in the lab exam and the results were very disappointing. 11 students scored 5 or 6 points, demonstrating partial knowledge. The TLC results were better - 37 of 51 students achieved a score of 7 or more and another 12 received scores of 5 or 6, demonstrating partial knowledge of this skill. All but 2 students could set up and run the TLC correctly, but their interpretation of their results was not always complete. This is an acceptable percentage.
CHEM G220L	cSLO 2	Spring 2018	In this assessment, we defined success as getting the problem 100% correct, but we also kept track of five metrics to see which part of the problem they were struggling with if they got it wrong. While 70% of students assessed got the problem completely correct, the following metrics were met with the following success: 1) Correct unknown (conclusion) – 91% 2) Conclusion is consistent with data (even if data is wrong) – 96% 3) Correct solubility data collected – 89% 4) Correct melting point data collected (w/in 1 °C) – 87% 5) Correct TLC data collected – 100% Based on this data, it seems that while students were overwhelmingly able to identify their unknown correctly (91%), only 70% did this while also collecting completely correct data.They may have had enough data to make a correct identification, or they drew a conclusion without complete logic. If looking at how many metrics were met (out of 5), students averaged meeting 4.6 out of 5 metrics.This can roughly be correlated with students getting the problem 93% correct (instead of 100% correct). The data was also broken down by lab section, but there was no difference in performance across the two lab sections assessed. Overall the students did well on meeting the criteria laid out by this assessment, and we consider their performance on this SLO to be adequate.
CHEM G220L	cSLO 3	Spring 2017	The SLO was assessed by looking at how many students successfully interpret the spectra to determine the correct structure of the compound. Students had an average score of 6 out of 8 maximum possible points. 8 out of 16 students got full points with correct structure and sufficient interpretation

Course Name	cSLO	Semester Assessed	cSLO Data Evaluation
			details. One student got 6 out of 8 possible points with very close structure with sufficient details. 5 students got 4.5 points with partially correct analysis of the spectra and related structure. Two students got 2-3 points and were not able to interpret and determine the unknown. Overall 56% of the students were considered to meet the SLO.
CHEM G220L	cSLO 5*	Fall 2016	Several questions were analyzed: Students were asked to assess solubility data to determine the best solvent for recrystallization and then to calculate how much solvent would be needed. 34/43 students earned full credit for this portion. Students were asked to calculate the specific rotation of an optically active compound from provided data. 33 students earned full credit and 8 students earned half credit. On the lab practical, students conducted TLC of unknowns samples. Most students completed the TLC correctly, but only half of them could correctly identify which of the two compounds was the more polar.
CHEM G225	cSLO 1	Spring 2017	8 of 29 students (27.6%) received full credit (15 points) for this three part questions, while another 15 students (51.7%) missed only 1 or 2 points, mostly from incorrect or missing R/S designation for chiral centers. These students along with another 3 students who scored 12 points are considered to have met the SLO - 89.7% of the students. The remaining three students scored 8-11 points on the questions.
CHEM G225	cSLO 1*	Fall 2016	When 12 students were analyzed for the three questions listed earlier, total of 9, 11, and 12 students responded correctly. Looking at the data, I personally feel that overall class did well and is an acceptable percentage. Based on the low correct response for the 1st question, I think the students did not practice enough nomenclature problems of this type.
CHEM G225	cSLO 2	Spring 2018	As a part of the final exam, students were asked to complete missing reactants, reagents or products for six different reactions learned during the semester. Two of these were assessed for this SLO. The first questions was a selective reduction of a ketone in the presence of a carboxylic acid - students had to provide the correct reducing agent (NaBH4). 23 students did this correctly. Another 8 students provided a less selective reducing agent (LiAlH4), so still realized that a reduction was taking place, so this is a partially correct answer. The final 9 students did not provide a reducing agent and got no credit for this question. It seems that many students were not clear on the selectivity of different reducing agents. The second question required students to provide the correct two starting materials for a Diels-Alder reaction producing a bicyclic product. 34 students correctly provided both compounds, while 5 students provide one correct compound and only one student could not draw either compound. The students in the class had learned this reaction well.
CHEM G225	cSLO 3	Fall 2015	Question 8: 9 of the 10 students answered correctly Question 29: 8 out of the 10 students answered correctly Question 45: 7 out of the 10 students answered correctly Question 50: 7 out of the 10 students answered correctly 7 out of the 10 students answered all 4 questions correctly Final exam Question: The average score for the question was 8 points out of 12 possible with a success rate of 64%. 5 students got it completely correct, 2 most of it correct and 3 students got zero.
CHEM G225	cSLO 4*	Spring 2016	Synthesis problems are the most difficult type encountered in organic chemistry, requiring students to know a large number of reactions and to combine them together to synthesize a complex molecule. This requires excellent critical thinking skills and usually only the A and B students in a class

Course Name	cSLO	Semester Assessed	cSLO Data Evaluation
			can do this. On these questions this semester, 5 students answered the questions at a level of 90% or above, three students earned 80%-90% and 7 students earned 65-79%. I consider these students (37% of the class) to have successfully accomplished this SLO. Many of the students who were unsuccessful in this SLO still passed the class due to their successful completion of other less demanding questions.
CHEM G225L	cSLO 1	Spring 2018	31 students had a mixture of two unknowns, a neutral organic compound and either an acidic or basic one. Ten students had a mixture of three compounds, one neutral, one acidic and one basic. 40 of 41 students (98%) successfully separated and purified their compounds; one student accidentally threw out one compound. 35 students (85%) correctly identified both/all of their compounds. 3 students incorrectly identified one of two compounds and 3 students incorrectly identified one of three compounds.
CHEM G225L	cSLO 3	Spring 2017	12 of 29 students received full credit, demonstrating good knowledge of spectral interpretation. 4 of 29 students scored 7, 8 or 9 (out of 10) points, with the correct structure determined, but insufficient explanation of how they arrived at their structure. These 55% of students are considered to have met the SLO. Another 7 students (24%) received 5 or 6 points, showing a closely related structure with some portions of the analysis correct. These students partially meet the SLO. The remaining 6 students received 0-3 points and were unable to determine a structure and did not meet the SLO.
CHEM G225L	cSLO 4*	Fall 2015	Lab Experiment 2: Electrophilic Aromatic Substitution Reaction Students had an average score of 13 points out of 15 possible All 10 students scored 75% and higher on the lab. Lab Experiment 6: Ester Synthesis Reaction Students had an average score of 20 points out of 24 possible All 10 students scored 75% and higher on the lab. Lab Experiment 8: Aldol Condensation Reaction Students had an average score of 14.6 points out of 16 possible All 10 students scored 80% and higher on the lab.
CHEM G225L	cSLO 5*	Spring 2016	Each student was assigned a mixture of two or three compounds. Those who correctly determined the identity of all of their compounds (39 students, 91% of the class) are considered to have successfully completed the experiment. Four students misidentified one of their compounds. No students misidentified more than one compound. Of the four students who were unsuccessful, one of them identified a close isomer while the other three made more significant errors of identification.
CHEM G225L	cSLO 5*	Fall 2016	11 Students had an average score of 15 points out of 20 possible points 5 studentsgot 90 % and above 1 student got 80-90 % 2 students got65-79% 3 students got < 65% Over all class did well on devising the detailed flowchart for isolating the mixture of compounds.

DATA PLANNING

Table 5. cSLOs assessed and corresponding Data Planning.
*Denotes historical cSLOs.

Course Name	cSLO	Semester Assessed	cSLO Data Planning
CHEM G110	cSLO 1	Spring 2017	In the Fall we noticed a decrease in retention on topics going from the quizzes to the midterm, and theorized that creating a self-study review assignment to be due before the midterm would increase their retention. Based on the results, students didn't increase dramatically on their initial knowledge of the material, but their retention and improvement from the quiz to the midterm greatly increased when compared to the previous semester. It can be concluded that providing a more structured study assignment rather than allowing them a more "free form" study week increased their ability to answer this question on the midterm. As a result of the positive improvements, we will continue to assign the review packet the week before the midterm.
CHEM G110	cSLO 1*	Fall 2015	In order to try and improve student performance on this introductory material, a special online homework will be assigned addressing pH and buffers (all of the course too). This will be an extra graded assignment besides their course syllabus, which already provides the students many examples regarding acidity and pH and buffer reactions. This result will be measure against the next semester, which will carry new syllabi for each topic being covered and a new textbook. The new syllabi will also have new online homework assignments reflecting this material and all of the material covered throughout the course. In the past, I have seen an improvement in this area due to the extra assigned worksheet which student found very helpful. We increased the number of correct answers by 3% from the previous semester.
CHEM G110	cSLO 2	Spring 2018	This semester (Spring 2018) is the first time we have assessed this SLO. Students fell just short of meeting the goals of this SLO (64%). Due to the large disparity between the some of the lab sections, I will be discussing with the lab instructors for next semester about teaching methods used for this topic during the lab activity. I will provide some guided questions that the instructors can use as they guide the students through the formative assessment that occurred before the summative quiz that was administered and assessed in this SLO. We will assess this SLO again in Fall 2018, and we will also be assessing the relevant questions on their multiple choice quiz and the Midterm to see if there are any large disparities there as well.
CHEM G110	cSLO 3*	Spring 2016	In order to address the unsatisfactory number of correct responses for Question 2 (predicting products of important chemical reactions), there will be an improvement in the student self-study packet that is used in addition to their lecture time to teach the subject. It is suspected that many students understand the general idea of addition reactions, but they may struggle with the nuances (realizing that this reaction creates two products or not knowing which of the two products is the major product). It is possible that the details of this type of question are leading to students choosing the wrong answer. As a result, the packets will expand upon and focus on these nuances and see if that results in an increase in the percentage of students answering correctly.
CHEM G110	cSLO 4	Fall 2017	This semester (Fall 2017) is the first time we have assessed this SLO. Students fell just short of meeting the goals of this SLO (67%). Due to the large disparity between the daytime and night sections (75% vs. 44% success), I will be discussing with the nighttime instructors in more detail regarding how they are teaching the organic reactions. In addition, I will be adding an extra lecture day to the two-day Unit 7 lecture time (the students' first organic unit of the semester where they learn these reactions). I suspect that Unit 7 needs more time since it coincides on the schedule with their Midterm and is their first exposure to organic chemistry. I plan to add a third day to their Unit 7 lecture schedule, and have this third day take place after their Midterm exam. This third

Course Name	cSLO	Semester Assessed	cSLO Data Planning
			day will be dedicated to teaching the reactions from that Unit (the first two days will cover notation and naming). I will be recommending this lecture schedule change to all instructors.
CHEM G110	cSLO 4	Spring 2018	This semester (Spring 2018) is the third time we have assessed this SLO. After the first assessment in Spring 2017, we implemented a Final Review packet to help improve retention on this topic for the Final Exam. The implementation of the Final Review, in addition to the use of a Final Review extra credit session, led to increased success rates. However, there was a large disparity still observed between the daytime and nighttime sections in Fall 2017. Efforts were made to improve student success on this topic by assessing teaching methods on this topic, which led to increased overall success rates in the nighttime sections. Our overall success rates were just shy (69% success) of our goal of 70% success, so we will move on to another SLO next semester. However, efforts will be made to standardize the way the Final Review packet is administered in all sections in addition to the use of the Extra Credit review session. We want to make sure all instructors are administering these assignments in the way they were meant to be implemented in an effort to maintain student success in all sections.
CHEM G110	cSLO 5*	Fall 2016	For the most part, students seemed to understand how to problem-solve and also qualitatively interpret their data for the Calorimetry experiment. However, success rates could still be improved so that a larger number of students are able to correctly answer BOTH parts of this question, with retention to the midterm. In general, the self-study packets that the students complete to reinforce and teach themselves the lecture concepts are being reworked in a way that is more interactive and able to be utilized during lecture. This process is not geared toward this specific SLO, but will likely help overall success rates, especially in the daytime sections where the student demographic tends to be younger and less mature in their study habits. In addition, students could likely benefit from a more structured midterm exam review that will help them rework these problems closer to the exam. A self-study packet that reviews for the exam will be created in an effort to boost retention on not only this, but other topics. Many students in this particular intro-level class do not have well-developed independent study skills, so they will likely benefit from such an activity.
CHEM G110L	cSLO 1	Fall 2017	This semester (Fall 2017) is the first time we have assessed this SLO. Students met the criteria with a success rate of 74%. We will try to increase the success rate by stressing to the students (during pre-lab lecture) that they need to perform the technique more carefully. Although the directions indicate a rate of temperature increase to follow, the instructors will stress this point and make sure the students understand that failure to follow that step could jeopardize the accuracy of their results. We will assess a different lab SLO next semester.
CHEM G110L	cSLO 2	Spring 2017	Last semester (Fall 2016), students were unsuccessfully able to correlate the lecture topics to the lab questions. This semester, there was a dramatic increase in their ability to answer the question more thoroughly. However, there is still room for improvement. There could be two reasons for this increase, which were changes made in Spring 2017 based on the findings from Fall 2016: 1) We moved the lab to one week later in the course, following a lecture quiz on the relevant topics. 2) At the beginning of the semester, the students completed a dry lab activity that guided them through the proper way to answer free-response essay-style lab questions. We will continue to administer the Week 1 dry lab activity and will continue to work on the lab schedule to increase student connections between lecture material and lab observations.

Course Name	cSLO	Semester Assessed	cSLO Data Planning
CHEM G110L	cSLO 3	Spring 2018	This semester (Spring 2018) is the first time we have assessed this SLO. Students fell short of meeting the goals of this SLO (only 40% recorded the volume correctly). Even though the students watched a video beforehand explaining the proper technique for recording buret volume, many of them still struggled to accurately record the volume. As a result, I will be adding a couple of buret reading problems into their workbook, which will be checked by the instructor during class for accuracy prior to them attempting the lab activity. We will assess this SLO again in Fall 2018.
CHEM G110L	cSLO 5*	Fall 2016	Although we covered this topic fairly in depth during lecture, students were unsuccessfully able to apply the relevant topics to a free response question related to lab observations. This lab activity will be moved to a week later in the schedule to see if allowing the students more time to absorb the lecture content will improve their ability to apply the lecture topics to their lab observations. In addition, efforts will be made earlier in the semester to assist students with the general skill of answering analytical essay-style questions. A worksheet will be developed to help them learn this skill, which should help them generally on their lab assignments throughout the semester.
CHEM G130	cSLO 1*	Summer 2017	Despite being a smaller class, collaborative effort was not realized in the class. Majority of the students relied on individual effort with few that would pair up with familiar faces. This also resulted in a poorer performance this semester compared to last semester. For future classes, it may be necessary to actively steer collaborative discussion in class by assigning groups instead of allowing students to do so passively. Implementation of a peer-evaluation system may also be helpful to keep students accountable during the semester.
CHEM G130	cSLO 2*	Fall 2016	Based on the assessment results, the difficulty for most students starts earlier in the semester, in chapter 4 with memorizing polyatomic ions and writing chemical formulas. In chapter 4, students have to memorize a large quantity of material. Long term memorization is crucial to apply the concept throughout the semester. Students often cram the material and know the ions and concepts short term, but cannot apply the material long term. During the spring 2017 semester, the plan is to give students a few ions to memorize each week starting from the first week. Even though the concept of naming will not be covered until week 4, students will begin memorizing two or three polyatomic ions the first week and be be quizzed regularly with the other material. The goal is for students not to be overwhelmed with the amount of material for memorization in chapter 4 and allow them to focus on the concept of writing formulas. The second action for the spring 2017 semester is to apply more active learning in chapter 4. To make sure students do not fall behind or get the help they need, students will be broken apart into small groups of 4 where they will be immersed in completing short assignments. The instructor will then work with the groups to assist groups of students. Students will be able to get instruction from their peers as well as the instructor. The goal is to see if students learn the material more effectively at the beginning of the semester, if this translates into greater assessment results at the end of the semester.
CHEM G130	cSLO 2*	Spring 2017	The difficulty for most students starts earlier in the semester, in chapter 4 with memorizing polyatomic ions and writing chemical formulas. One explanation for the drop in assessment results for the Tuesday -Thursday evening section is that the class lecture size doubled in the Spring 2017 from 25 to 50. The instructor may not have been able to provide as much individual time as he had in the Fall 2016 semester. In the assessment in the Fall 2016 semester, I stated that I was going to incorporate more active learning activities in Chapter 4. I did this as well

Course Name	cSLO	Semester Assessed	cSLO Data Planning
			as an institute an online quiz game Kahoot. The students really enjoyed this game throughout the semester and the fun aided in their learning. Lastly, an additional change I made throughout the semester was a handout called concepts checks. I would give them out at the beginning of lecture which included problems from the previous lecture or lectures. These were timed problems or questions. We then went over the concepts and had discussion. Students really focused on these because they were not graded but had the format of an exam or quiz. I noticed great improvement on exams on difficult concepts. However, since the evening instructors results were so strong during the Fall 2016, I discussed some minor changes but did not insist because I did not see a need. I made changes to the daytime sections as the results were not where I wanted. I will pass on the concept checks to him for future use. In the Fall 2017 semester, I will assess a completely different concept at the beginning of the semester. I would like to assess using the concept checks early in the semester and then applying to a larger group of students.
CHEM G130L	cSLO 2*	Spring 2016	The approach would be to provide students with more discussion questions during lecture to explain the theory of electron configurations.
CHEM G130L	cSLO 4*	Fall 2016	Since 97% of students were able to apply the skill of recording an estimated digit, no further assessment of this skill will be done. For the spring 2017 semester, a separate laboratory skill will be assessed. Currently, there is only one student learning outcome for Chemistry 130 Laboratory. The laboratory outcome is very general and does not highlight specific skills students should learn. For the upcoming year, three new student learning outcomes for the Chemistry 130 Laboratory will be written and implemented into the course. This will allow for a variety of laboratory skills to be assessed.
CHEM G130L	cSLO 4*	Spring 2017	I assessed this same concept and same experiment in the Fall 2016 semester. However, the Fall 2016 results were slightly higher in percentage . However, with an assessment result of 90 percentile for 5 sections of chemistry 130 laboratory, I feel no further assessment of this concept is needed. However, I plan on making minor changes to laboratory experiments where I instruct students throughout the semester to always record the uncertainty. Students often become not as detailed on measurement towards the end of the semester because their is gap when recording data in the laboratory. The changes I will make will stress this concept more with the desire that writing the uncertainty will carry forward to the end of the semester.
CHEM G130L	cSLO 5*	Summer 2017	In general, the vast majority of the students understood the basic principles in making a solution. Additionally, all students were required to make a solution in their lab practicum from scratch which further reinforced the concept. However, students may not be able to recognize this concept when “mindlessly” following the procedures of a lab manual. This time around, more time was spent to reinforce this concept in lecture and again during lab. As a result, therewas a much better improvement compared to last summer
CHEM G180	cSLO 1	Spring 2017	Since students demonstrated the least proficiency at writing isotope symbols, the online homework assignment that students are asked to complete after being taught how to write isotope symbols will be adjusted to increase the number ofquestions that require students to write isotope symbols.It is hoped that additional, graded practice at writing isotope symbols will improve student proficiency at writing isotope symbols.
CHEM G180	cSLO 2	Fall 2017	A multiple choice question seems unsuited to assessing student learning in this case. Correctly answering this question requires the use of multiple concepts that have been learned over the course of the semester. It’s likely that most

Course Name	cSLO	Semester Assessed	cSLO Data Planning
			students understood all but one of these concepts, but with a multiple choice question, misunderstanding only one of many necessary concepts still leads to an incorrect answer. The observed very low success rate is probably misleading. In the future a more fine-grained question will be used to assess the SLO, a question that allows for a more nuanced assessment of student results.
CHEM G180	cSLO 3	Fall 2016	When next this SLO is assessed better communication between instructors as to how to record and report assessment data will occur so that each instructor is reporting the same assessment data. When asking this question in the future, instructors will split the overall question into many subquestions. E.g., instead of asking the question as 1. In which solvent is ammonia more likely to be soluble, methanol or carbon disulfide? instructors will ask the question as 1. In which solvent is ammonia more likely to be soluble, methanol or carbon disulfide? (a) Is ammonia considered to be polar or nonpolar? Justify your answer. (b) What is the strongest interparticle force in a pure sample of methanol? Is methanol considered to be polar or nonpolar? Justify both your answers. (c) What is the strongest interparticle force in a pure sample of carbon disulfide? Is carbon disulfide considered to be polar or nonpolar? Justify both your answers. (d) In which solvent is ammonia more likely to be soluble, methanol or carbon disulfide? Explain your answer. (e) What is the strongest interparticle force attracting ammonia to your answer to part (d)? Justify your answer.
CHEM G180	cSLO 3*	Fall 2015	With the exception of section 54479, the percentage of students who correctly determined the empirical formula of a compound from combustion analysis data were comparable to the results of the previous two semesters, results that ranged from 55-72% correct. Data were collected on which step in the procedure for determining the empirical formula of a compound from combustion analysis data is the one where the initial mistake occurred. These data indicate that most students who incorrectly determined the empirical formula of a chemical compound from combustion analysis data failed to successfully perform the first of the five steps in the procedure. Nearly all of the students who incorrectly performed the fist step of the procedure were unsuccessful because they didn't know how to perform that first step. Put another way, these students didn't make a mistake while implementing the first step of the procedure; they didn't know the first step of the procedure. This was also found to be the case during the summer 2015 term. Improving the performance of students that don't know the first step of the procedure is a problem we don't know how to solve. We believe that we have taken steps to make it clear that being able to determine the empirical formula of a compound from combustion analysis data is important. Nearly two hours of lecture time were spent on this topic in all three sections, and in the cases of sections 54466 and 54469 these two hours represented two-sevenths of the total amount of lecture time spent preparing students for their exam. (The instructor of section 54479 gives fewer exams during the semester, so these two hours represent a smaller proportion of the lecture time spent preparing students for their comparable exam, which is likely a factor in the poorer performance of these students on the SLO assessment.) Not only that, but audio-visual presentations covering this topic were available for viewing on the Blackboard sites of all three sections. In the cases of sections 54466 and 54469, a question involving determining the empirical formula of a compound from combustion analysis data was present on the practice exam. All of these indicate to students that being able to determine the empirical formula of a compound from combustion analysis data is important. We suspect that students who don't know the first

Course Name	cSLO	Semester Assessed	cSLO Data Planning
			step of the procedure suffer from issues outside our control: the demands of a part- or full-time job, family obligations or difficulties, poor study habits, poor class attendance, etc. We've decided to focus our assessment on those students who know the procedure but make mistakes while implementing it. In the spring of 2016 we will again collect data on which step in the procedure is the one where the initial mistake occurred, but will also look into the types of mistakes made by students who know the procedure. Perhaps by learning what types of mistakes these students make, we can improve their performance.
CHEM G180L	cSLO 1	Spring 2018	Section 61300 had a much lower success rate than that of other sections for the recording of volume to the correct number of significant figures. The instructor for section 61300 and I have discussed possible means of improving student performance and together decided that a reminder of the importance of significant figures will be added to the introduction for this lab exercise in future semesters. Specifically, students will be told that the most common mistake made during Experiment 4: Determination of Density is the misreporting of the significant figures of measurements. It is hoped that if students are reminded of the importance of the significant figures to which measurements are reported, they will take more care when reporting their measured values.
CHEM G180L	cSLO 3	Summer 2017	Since CHEM 180 students demonstrated a high degree of proficiency in calculating the relative average deviation in their experimental results for the Gravimetric Determination of Sulfate experiment, there is no need to change instruction to improve student learning of this outcome.While those students who calculated the relative average deviation tended to do so correctly, there were several students who failed to submit the lab report for this lab experiment. Unlike all of the previous lab reports, the lab report for this experiment was finished at home and submitted the following class period. Previous lab reports were finished in class and submitted prior to leaving class. It is suspected that the students who did not submit a lab report for this experimentforgot that there was a lab report due. In the future, students who fail to submit a lab report will be reminded to do so.
CHEM G180L	cSLO 4*	Fall 2015	Our benchmark for a satisfactory level of accomplishment is that 70% of students properly adjust all three of their Bunsen burner flames. For CHEM G180L as a whole, the results are acceptable as 78.02% of students (142/182) properly adjusted all three of their Bunsen burner flames. (Note: the 23 students who earned a 1/1 in section 56042 were considered to have been successful, despite their being assessed on the basis of a single Bunsen burner instead of three like all other students.) However, when examined separately, results are only acceptable for five of the eight lab sections. It's possible that these differences are a function of lab instructor. Perhaps the instructors of sections 54480, 58798, and 58919 assess student performance more strictly than those instructors who teach the other five lab sections, or maybe the instructors of sections 54480, 58798, and 58919 differently demonstrate the correct adjustment and positioning of the Bunsen burner flames. During the spring 2015 term, discussions between the various CHEM 180L instructors led to the decision to also try presenting the demonstration of the correct adjustment and positioning of the Bunsen burner flames at the start of day 2 of the Gravimetric Determination of Sulfate experiment via a pre-recorded video. It was decided that the pre-recorded video would be used to demonstrate these techniques beginning with the spring 2016 term. In addition to being shown at the start of day 2 of the Gravimetric Determination of Sulfate experiment, this video will be posted to each instructor's Blackboard site so that it is available for viewing by

Course Name	cSLO	Semester Assessed	cSLO Data Planning
			students before class. Perhaps a consistent demonstration of the correct adjustment and positioning of the Bunsen burner flames will lead to more consistent student success results.
CHEM G185	cSLO 1	Spring 2017	The kinetics chapter is our first chapter of the semester, and very mathematically complex. This semester I implemented an online tutoring aide, to see if it strengthens students' ability to solve these complex, multi-step, problems. The students' performance on these problems indicates that the online tutoring system was helpful.
CHEM G185	cSLO 3*	Spring 2018	I last assessed this SLO in 2016, where only 55% of the class was able to answer correctly. I have since added an online tutoring module, ALEKS, which seems to have improved the students understanding in buffers and acid base equilibra. Additionally, new problem sets addressing this issue had been created and implemented.
CHEM G185	cSLO 4*	Summer 2017	Improved student success rates were achieved by doing additional in-class problem solving sessions and discussions before taking the Final Exam. An evaluation of the four students who missed the question on the Final Exam all gave the same response. They all chose the closest response before reducing the overall equation to the lowest common denominator. It could be assumed that their error was mathematical and not due to a lack of understanding how to successfully balance a REDOX equation. To ensure continued success in this Student Learning Objective, additional attention will be given to students that reinforce the importance of reducingfractions in all chemical equations.
CHEM G185L	cSLO 1	Spring 2017	Students had a hard time separating cadmium and copper. The lab procedure for this step will be changed to eliminate the sodium thionite step. A new step using the solubility property of cadmium in sulfuric acid will be tried next semester.
CHEM G185L	cSLO 3	Spring 2018	I will continue to teach various lab notebook writing skills, preparing students for their future as scientists. The results show this is a worthwhile effort, and successful.
CHEM G220	cSLO 1	Fall 2017	This semester, online homework was first used for organic chemistry, and scores on most topics reflected improvement. However, for nomenclature and stereochemistry, the online homework was less helpful, as the questions were multiple choice, and for stereochemistry, there are only two choices for each stereocenter, so getting the correct answer requires no more than two tries. Additional handwritten questions for homework or quizzes might help students to correctly name compounds.
CHEM G220	cSLO 1*	Fall 2016	The course format offers lots of opportunities for students to practice drawing structures, which is reflected in the high overall success rate. The workbook doesn't provide much practice for Fischer projections, so an additional opportunity to practice these should be added to the problem sets.
CHEM G220	cSLO 2	Spring 2018	This semester (Spring 2018) is the first time we have assessed this SLO. Students met the minimum goal based on three metrics for success on the Midterm (70% success). The most concerning aspect of the data analysis was that students were not retaining the problem-solving knowledge going into the Final Exam. Although a cumulative review worksheet was provided for the chemical reactions, no structured review was given for other topics like the SLO assessed here. For Fall 2018, an additional Final Review worksheet will be prepared to cover non-reaction topics and we will reassess this same SLO in addition to a new SLO.
CHEM G220	cSLO 5	Spring 2017	As mentioned in Step 4, this is a very difficult process requiring application of almost everything learned during the semester; memorization of the course material is not sufficient to allow successful completion of synthesis questions. I

Course Name	cSLO	Semester Assessed	cSLO Data Planning
			think providing practice worksheets with answer keys that they can look at periodically will help greatly. After providing practice worksheets, I will try to gage them by giving them one more quiz completely based on synthesis problems. That's how student will get to how much they need to improve towards the final exam.
CHEM G220L	cSLO 1	Fall 2017	The experiment where they learn how to carry out extraction using the same compounds as in the assessment is a guided inquiry experiment, requiring students to work with their group to determine the identity of the unknown compound, much as was required for the lab exam. Perhaps additional class discussion of the results would help some students to understand the results they have obtained.
CHEM G220L	cSLO 2	Spring 2018	This semester (Spring 2018) is the first time we have assessed this SLO. Student met the minimum goal based on five metrics for success (70% success). However, based on a simpler measure of just obtaining the correct unknown identity, 91% of students succeeded in this effort. We will assess a different lab SLO in Fall 2018.
CHEM G220L	cSLO 3	Spring 2017	Interpretation problem sets were provided to students in lab for practice. Still many students are unsuccessful. In order to improve the success rate, I will provide more problem sets on interpretation of the unknown compounds. Also, while teaching the spectroscopy topic I will try to assess all students, via in class questions, if they understand the concept well.
CHEM G220L	cSLO 5*	Fall 2016	Polarity of compounds in TLC continues to be a difficult concept for students. A previous assessment of this concept demonstrated very low success rates, so additional information was added to the lab manual and to their lab report questions. I made a point of discussing this with students as a group and individually to try to remedy their faulty thinking, but the lab practical demonstrated that many are still confused, although the numbers are not as bad as the previous assessment. I will continue to try to clarify this concept for students throughout the semester.
CHEM G225	cSLO 1	Spring 2017	Nomenclature is incorporated consistently throughout the entire year of organic chemistry, so students don't have an opportunity to forget it, as evidenced by the high success rate on this set of questions. A brief review of R/S designations, a topic from first semester organic chemistry. would probably improve the scores of the 15 students who missed one or two points for these parts of the naming.
CHEM G225	cSLO 1*	Fall 2016	At this stage in the semester, students have to memorize a lot of nomenclature structures. I feel the flashcards will be helpful in memorizing the nomenclature. Also, practice worksheets with some challenging problems followed their an answer keys that they can look at periodically through the semester will help greatly.
CHEM G225	cSLO 2	Spring 2018	Additional information and examples about selectivity of reducing agents might help students answer questions of this type more accurately. The results for the Diels-Alder reaction were satisfactory and no changes need to be made.
CHEM G225	cSLO 3	Fall 2015	I will make additional problems via handouts or homework for the students to work on using mechanisms they have never seen before. This will help them in truly understanding how to draw a mechanism rather than memorizing the ones they have in their textbooks.
CHEM G225	cSLO 4*	Spring 2016	As mentioned in Data Evaluation, this is a very difficult process requiring application of almost everything learned during the semester; memorization of the course material is not sufficient to allow successful completion of synthesis questions. In recent semesters, I have used class time for some group synthesis problems; I will continue to do this as much as time allows.

Course Name	cSLO	Semester Assessed	cSLO Data Planning
CHEM G225L	cSLO 1	Spring 2018	Most of the errors came in mis-interpretation of mass spectra or NMR spectra. The students were already given a review problem set on these topics before doing the lab, but more practice is always helpful.
CHEM G225L	cSLO 3	Spring 2017	Over the past few years, additional spectroscopy problems and interpretation of spectra have been added to the laboratory portion of the course, but some students still are unsuccessful. Introduction of online homework will be implemented for the fall lecture course. Perhaps if some spectroscopy problems are added to this, more students will practice spectral interpretation.
CHEM G225L	cSLO 4*	Fall 2015	I have made several changes to my prelab discussions to include the reactions as well as the laboratory techniques the students will be working on for that class. I will continue to do this. And be more proactive during the class period to help answer questions for the postlab section of the report.
CHEM G225L	cSLO 5*	Spring 2016	The high success rate indicates that most students have enough support to successfully complete this challenging assignment where they devise their own procedures. I will try to check in with all students as they work to be sure they have the information they need to reach the correct identification.
CHEM G225L	cSLO 5*	Fall 2016	Relatively good performance of the class indicates that most students had enough support to successfully complete the devising of the flowchart when taught first time in the lab. In order to improve it further, I will try to check in with all students while they work on initial devising stage of their experimental work and be sure they have the all the needed information. This is important as it is the basis for the next step of separation of a mixture of compounds.