

Crafton Hills College Chemistry SLOs

Crafton Hills College Chemistry

Chemistry is the study of matter: The structure and properties of matter, the transformations from one form of matter to another and the associated energy transformations.

Chemistry Mission Statement

The mission of the chemistry department at Crafton Hills College is to advance the education and success of the students in a quality-learning environment. We serve students who intend to major in such diverse fields such as biochemistry, biotechnology, engineering, medicine, health sciences, biology, physics, and of course chemistry. We offer all the core classes needed to transfer as well as courses to complete general education.

Within our department we have an outstanding chemistry faculty striving to maintain an aggressive and well-respected chemistry program. The chemistry faculty endeavor to help students become life-long learners and explorers of the relationship of chemistry to other fields.

Chemistry Program Student Learning Outcomes (SLO's) Skills Students Will Acquire in Chemistry Courses

1. Knowledge of the basic areas of chemistry such as the structure and properties of matter, the transformations from one form of matter to another and the associated energy transformations.
2. Comprehension and use of laboratory skills in synthetic, quantitative and instrumental methods as scientific approaches to gathering and verifying knowledge.
3. Critical thinking in chemistry including interpretation, evaluation, explanation and critical inquiry; how to ask appropriate questions, gather relevant information efficiently and creatively, sort through this information, reason logically from this information and come to reliable and trustworthy conclusions.
4. Ability to collect, analyze and articulate results clearly and effectively in speech and in writing in an acceptable style of presentation. The ability to follow directions given both in written and verbal form.

Courses	Content		Critical Thinking	Communication
	SLO 1	SLO 2	SLO 3	SLO 4
CHEM 101	X	X	X	X
CHEM 150	X	X	X	X
CHEM 151	X	X	X	X
CHEM 102	X	X	X	X
CHEM 212	X	X	X	X
CHEM 213	X	X	X	X
CHEM 123	X		X	X

SLOs Revised and Approved by Chemistry Discipline 9-2008

Assessment of Student Learning Outcomes

The Department of Chemistry will assess the students' core learning outcomes using examinations, laboratory and classroom assignments and presentations. The results of the assessments will be used to improve student achievement and program effectiveness.

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Discussions between Chemistry faculty on SLOs:

Discussion on SLOs between the full time faculty of chemistry have been occurring thorough-out each semester, since Fall 2000. Initially the discussions were for just CHEM 101, when SLOs where established, now all of the courses offered are discussed with faculty and staff regularly. The SLOs for CHEM 101 have been implemented and assessed every semester since fall 2002.

Currently all of our courses offered in chemistry have SLOs and all courses have assessed SLOs. Instructors have analyzed the results, discussed results with other faculty and staff, and made appropriate changes to the course to improve the outcome results for students.

Dates of Chemistry Faculty discussions on SLOs: (This represents a few selected dates; many more discussions have taken place that are not listed here).

Aug 2002	May 2004	Jan 2006	Dec 2007	March 30, 2009
Dec 2002	Aug 2004	May 2006	Jan 2008	Aug 19, 2009
Jan 2003	Dec 2004	Aug 2006	May 2008	Aug 25, 26 2009
May 2003	Jan 2005	Dec 2006	Aug 18, 2008	Dec 16, 2009
Aug 2003	May 2005	Jan 2007	Sept 22, 2008	Jan 21, 2010
Dec 2003	Aug 2005	May 2007	Dec 17, 2008	Apr 28, 2010
Jan 2004	Dec 2005	Aug 2007	Jan 26, 2009	

Examples of discussions and changes: (See each course for more details)

CHEM 101: Evaluating our students' success through the number of percent of correct responses to the SLO questions, we noticed a steady increase in the percent of students with 80% or higher until spring 05. In spring 06, additional modifications were made to the lecture material (mainly exam review sheets) and the numbers then began to increase again. The changes also affected the percent of students who answered only 20% or less of the questions correctly. Changes such as, revised lecture notes, revised PowerPoint presentations, additional problems worked out in class, in class assessment using "Learning Checks", exam review sheets, and additional homework problems assigned are examples of some of the techniques instructors have used.

CHEM 102:

We have seen an increase in the success of our students overall. The percent of students who correctly answered two or three of the questions on the final exam increased from spring 08 to summer 08 from 66.7 % to 92.9%. The lab assessment was measured by comparing the students' scores from experiment 1 lab reports comparing it to experiment 9 reports. Reported is the percent of students who scored 90% or higher on lab reports. Data shows an increase for experiment 9 spring 2008 to summer 2008 from 95.2 % to 100%.

Instructors have analyzed the results, discussed results with other faculty and staff, and made appropriate changes to the course to improve the outcome results for students. Changes such as, revised lecture notes, revised PowerPoint presentations, additional problems worked out in class, review sheets, and additional homework problems assigned are examples of some of the techniques instructors have used.

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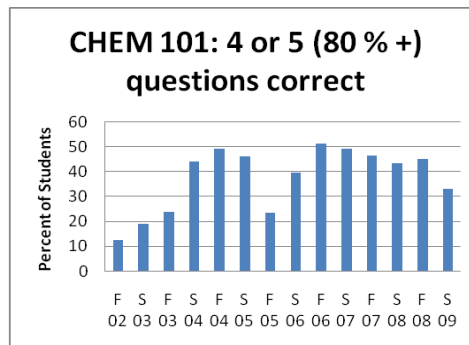
Course Level Learning Outcomes for CHEM 101 (Introduction to Chemistry)

1. The ability to apply mathematics to chemical measurements.
2. The ability to do problems involving reaction stoichiometry.
3. Comprehension and use of laboratory skills in synthetic, quantitative and instrumental methods as scientific approaches to gathering and verifying knowledge.
4. Critical thinking in chemistry including interpretation, evaluation, explanation and critical inquiry; how to ask appropriate questions, gather relevant information efficiently and creatively, sort through this information, reason logically from this information and come to reliable and trustworthy conclusions.
5. The ability to collect, analyze, and articulate results clearly and effectively in speech and in writing in an acceptable style of presentation. The ability to follow directions given both in written and verbal form.

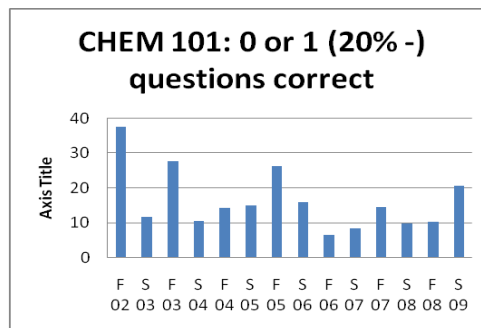
Specific Outcomes assessed for the data presented	SLO measured
Solve for moles of gases, solids and solutions	1,4
Solve and perform molarity calculations	1,4
Solve stoichiometry problems involving gases, solids and solutions.	1,2,4
Solve stoichiometry problems involving limiting reagents	1,2,4
Solve chemistry problems involving gas laws	1,2,4
Lab Assessment	3,5

Results, discussions and changes made from results: (Data on separate Excel sheet)

Results: Individual topics are evaluated each semester, and changes made by instructors, through discussion with other faculty members. Evaluating our students' success through the number of percent of correct responses to the SLO questions, we noticed a steady increase in the percent of students with 80% or higher until spring 05. In spring 06, additional modifications were made to the lecture material (mainly exam review sheets) and the numbers then began to increase again. The changes also affected the percent of students who answered only 20% or less of the questions correctly.



Discussions and Changes: Instructors have analyzed the results, discussed results with other faculty and staff, and made appropriate changes to the course to improve the outcome results for students. Changes such as, revised lecture notes, revised PowerPoint presentations, additional problems worked out in class, in class assessment using "Learning Checks", exam review sheets, and additional homework problems assigned are examples of some of the techniques instructors have used.



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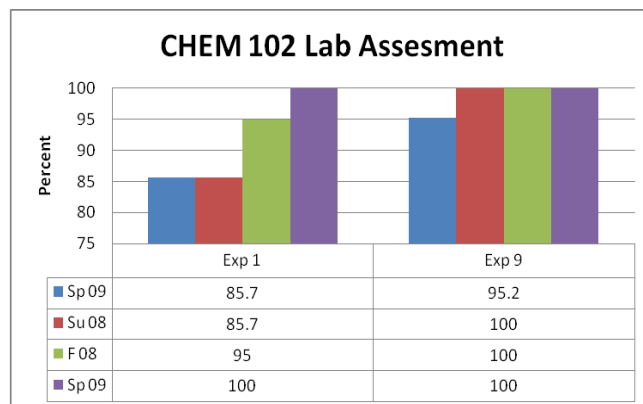
Course Level Learning Outcomes for CHEM 102 (Introduction to Organic Chemistry)

1. The ability to distinguish, construct and compare organic compounds utilizing structure, physical properties, nomenclature, synthesis and reactions.
2. Comprehension and use of laboratory skills in synthetic, quantitative and instrumental methods as scientific approaches to gathering and verifying knowledge.
3. Critical thinking in chemistry including interpretation, evaluation, explanation and critical inquiry; how to ask appropriate questions, gather relevant information efficiently and creatively, sort through this information, reason logically from this information and come to reliable and trustworthy conclusions.
4. The ability to collect, analyze, and articulate results clearly and effectively in speech and in writing in an acceptable style of presentation. The ability to follow directions given both in written and verbal form.

Specific Outcomes assessed for the data presented	SLO measured
Effectively use nomenclature to name or provide structures of organic compounds.	1,3
Classify organic compounds into various groups such as functional groups or reaction types.	1,3
Write and complete organic reaction equations.	1,3
Collect, analyze and present data and results effectively in the form of laboratory reports.	2,4

Results, discussions and changes made from results: (Data on separate Excel sheet)

Results: We have seen an increase in the success of our students overall. The percent of students who correctly answered two or three of the questions on the final exam increased from spring 08 to summer 08 from 66.7 % to 92.9%. The lab assessment was measured by comparing the students' scores from experiment 1 lab reports comparing it to experiment 9 reports. Reported is the percent of students who scored 90% or higher on lab reports. Data shows an increase for experiment 9, Spring 08 to summer 08 from 95.2 % to 100%. In spring 2009, 100% of the students scored 90% or higher on both experiments.



Discussions and Changes: Instructors have analyzed the results, discussed results with other faculty and staff, and made appropriate changes to the course to improve the outcome results for students. Changes such as, revised lecture notes, revised PowerPoint presentations, additional problems worked out in class, review sheets, and additional homework problems assigned are examples of some of the techniques instructors have used.

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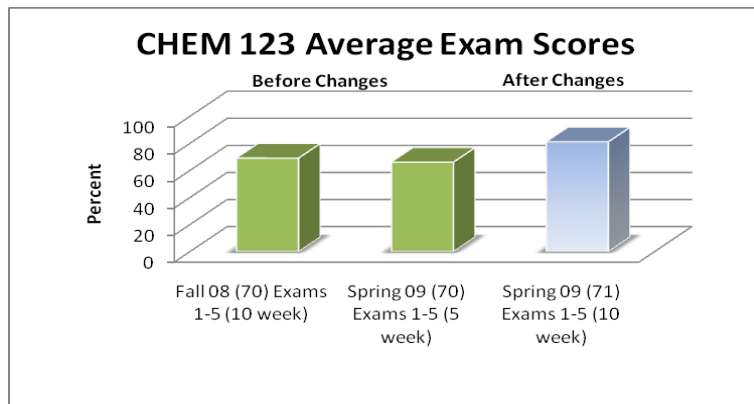
Course Level Learning Outcomes for CHEM 123 (Chemistry for Everyone)

1. Knowledge of the basic areas of chemistry such as the structure and properties of matter, the transformations from one form of matter to another and the associated energy transformations.
2. Critical thinking in chemistry including interpretation, evaluation, explanation and critical inquiry; how to ask appropriate questions, gather relevant information efficiently and creatively, sort through this information, reason logically from this information and come to reliable and trustworthy conclusions.
3. Ability to collect, analyze and articulate results clearly and effectively in speech and in writing in an acceptable style of presentation. The ability to follow directions given both in written and verbal form.

Specific Outcomes assessed for the data presented	SLO measured
Knowledge of basic areas of Chemistry	1,3
Participation in discussion boards	4

Results, discussions and changes made from results: (Data on separate Excel sheet)

Results: SLO 1 & 3 were measured by evaluating exams for this course. The average score for Fall 08 on all five exams was 69%, and for the first 3 exams of Spring 09 (Section 70) 63%. I made changes to the material presented and instructions I gave to the student starting on exam 4 & 5 for Spring 09 (Section 70), and all exams for Spring 09 (Section 71) (Only data for exams 1-3 are currently available, as the class is in progress when this is written). The average for all 5 exams for the 10 week course went from 69 % (Fall 08) to 81 % (Spring 09).



Discussions and Changes: This is an online chemistry course that was developed in 2008 and first offered in Fall 08. I noticed that the exam scores seemed consistently low, so I reviewed that material I presented, and the way I presented it and made changes. Discussions were made on this process between the full time faculty members to make the changes and adjustments the most reasonable for the students. The changes were made to the PowerPoint lectures, and I restated the instructions given to the students to make them more clear. The changes did show an increase in the grades which does reflect an increase in student knowledge of the basic areas of chemistry, and the interpretation and evaluation of the material presented in the course.

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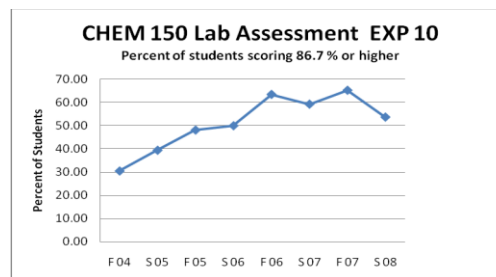
Course Level Learning Outcomes for CHEM 150 (General Chemistry I)

1. The ability to apply mathematics to chemical measurements.
2. The ability to do problems involving reaction stoichiometry.
3. Comprehension and use of laboratory skills in synthetic, quantitative and instrumental methods as scientific approaches to gathering and verifying knowledge.
4. Critical thinking in chemistry including interpretation, evaluation, explanation and critical inquiry; how to ask appropriate questions, gather relevant information efficiently and creatively, sort through this information, reason logically from this information and come to reliable and trustworthy conclusions.
5. The ability to collect, analyze, and articulate results clearly and effectively in speech and in writing in an acceptable style of presentation. The ability to follow directions given both in written and verbal form.

Specific Outcomes assessed for the data presented	SLO measured
Solve Clausius Claperyon equation problems	1,4
Interpret and generate Lewis Structures of atoms or molecules	4
Solve stoichiometry of gas problems	1,2,4
Solve molarity problems	1,2
Solve limiting reactant problems	1,2,4
Laboratory assessment such as laboratory skills, and reports	3,5

Results, discussions and changes made from results: (Data on separate Excel sheet)

Results: The results show that the students' outcomes have been fairly consistent over the last 4 years in the areas of SLOs 1, 2, & 4. In the area of Lab assessment, students' scores on Exp 10 report were used to evaluate their success. Students have shown an increase over time in student success, with 50 % or higher consistently since spring 06.



Discussions and Changes: Instructors have analyzed the results, discussed results with other faculty and staff, and made appropriate changes to the course to improve the outcome results for students. Changes such as, revised lecture notes, revised PowerPoint presentations, additional problems worked out in class, review sessions, review sheets, and additional homework problems assigned are examples of some of the techniques instructors have used. For the lab assessment, students were given a grading rubric for the experiment, starting fall 06, this explains the difference in grades for the students.

Changes in 2009: To better help students with laboratory skills and reports (SLOs 3 & 5), new experiments have been written and implemented using an electronic data collection system that is used with computers. Results of these changes will be assessed once more data can be collected.

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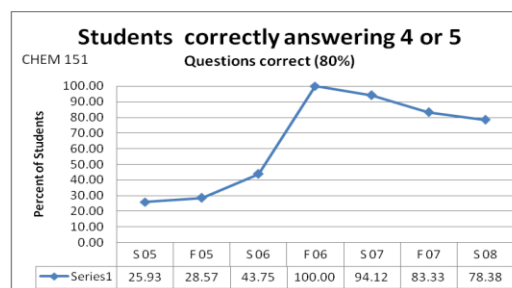
Course Level Learning Outcomes for CHEM 151 (General Chemistry II)

1. The ability to apply mathematics to chemical measurements.
2. The ability to do problems involving equilibrium and kinetics.
3. Comprehension and use of laboratory skills in synthetic, quantitative and instrumental methods as scientific approaches to gathering and verifying knowledge.
4. Critical thinking in chemistry including interpretation, evaluation, explanation and critical inquiry; how to ask appropriate questions, gather relevant information efficiently and creatively, sort through this information, reason logically from this information and come to reliable and trustworthy conclusions.
5. The ability to collect, analyze, and articulate results clearly and effectively in speech and in writing in an acceptable style of presentation. The ability to follow directions given both in written and verbal form.

Specific Outcomes assessed for the data presented	SLO measured
Solve activation energy problems	1,2,4
Solve Buffer calculations	1,2,4
Solve equilibrium calculations	1,2,4
Solve integrated rate law problems	1,2,4
Solve acid/base titration – pH calculations	1,2,4
Laboratory assessment such as laboratory skills, and reports	3,5

Results, discussions and changes made from results: (Data on separate Excel sheet)

Results: CHEM 151 is the second semester of a two semester course. All students from spring 05 – spring 08 correctly answered at least 3 of the five questions assessed. We have seen an increase in the success of our students overall.



Discussions and Changes: Instructors have analyzed the results, discussed results with other faculty and staff, and made appropriate changes to the course to improve the outcome results for students. Changes such as, revised lecture notes, revised PowerPoint presentations, additional problems worked out in class, review sessions, review sheets, and additional homework problems assigned, grading rubrics given to students, are examples of some of the techniques instructors have used.

Changes in 2009: To better help students with laboratory skills and reports (SLOs 3 & 5), new experiments have been written and implemented using an electronic data collection system that is used with computers. Results of these changes will be assessed once more data can be collected.

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Course Level Learning Outcomes for CHEM 212 (Organic Chemistry I)

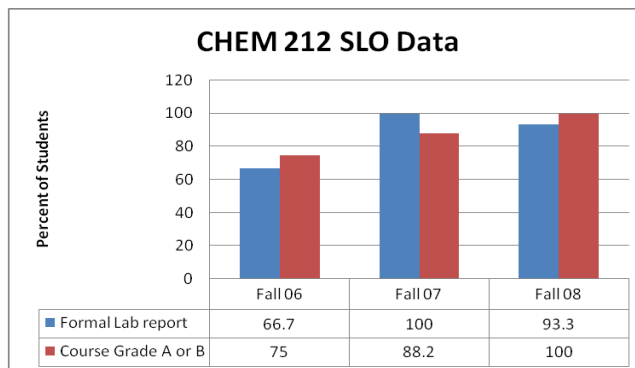
1. The ability to distinguish, construct and compare organic compounds utilizing structure, physical properties, nomenclature, synthesis and reactions.
2. Comprehension and use of laboratory skills in synthetic, quantitative and instrumental methods as scientific approaches to gathering and verifying knowledge.
3. Critical thinking in chemistry including interpretation, evaluation, explanation and critical inquiry; how to ask appropriate questions, gather relevant information efficiently and creatively, sort through this information, reason logically from this information and come to reliable and trustworthy conclusions.
4. The ability to collect, analyze, and articulate results clearly and effectively in speech and in writing in an acceptable style of presentation. The ability to follow directions given both in written and verbal form.

Specific Outcomes assessed for the data presented	SLO measured
Students will be able to effectively use nomenclature to name or provide structures of organic compounds.	1,3
Students will be able to classify organic compounds into various groups such as functional groups, carbon type, or reaction types.	1,3
Identify organic compound using spectroscopy data such as; MS, IR, NMR	1,3,4
Students will be able to collect, analyze and present data and results effectively in the form of laboratory reports, or research papers.	2,4

Results, discussions and changes made from results: (Data on separate Excel sheet)

Results: We have seen an increase in the success of our students overall. The percent of students who earn an A or B for the course has increases form 75 % in Fall 06, to 88.2 % Fall 07, to 100 % in Fall 08. The scores for the formal lab report has decreased from Fall 07 to Fall 08, however, they are still over 25 % higher than in Fall 06.

Discussions and Changes: Instructors have analyzed the results, discussed results with other faculty and staff, and made appropriate changes to the course to improve the outcome results for students. Changes such as, revised lecture notes, revised PowerPoint presentations, additional problems worked out in class, review sheets, and additional homework problems assigned are examples of some of the techniques instructors have used. I remind students many more times through out the year that for many universities, a B or better is required to transfer. This has encouraged them to keep up their grades.



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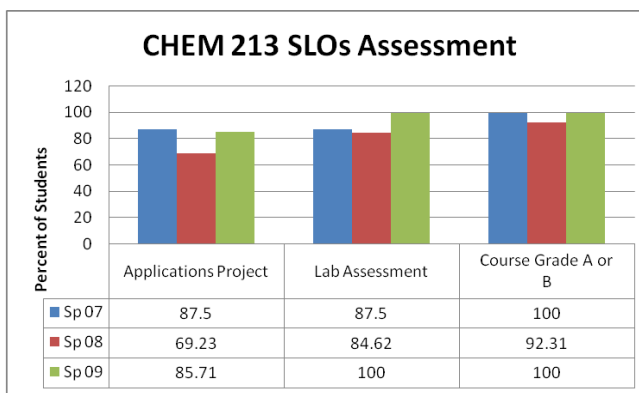
Course Level Learning Outcomes for CHEM 213 (Organic Chemistry II)

1. The ability to distinguish, construct and compare organic compounds utilizing structure, physical properties, nomenclature, synthesis and reactions.
2. Comprehension and use of laboratory skills in synthetic, quantitative and instrumental methods as scientific approaches to gathering and verifying knowledge.
3. Critical thinking in chemistry including interpretation, evaluation, explanation and critical inquiry; how to ask appropriate questions, gather relevant information efficiently and creatively, sort through this information, reason logically from this information and come to reliable and trustworthy conclusions.
4. The ability to collect, analyze, and articulate results clearly and effectively in speech and in writing in an acceptable style of presentation. The ability to follow directions given both in written and verbal form.

Specific Outcomes assessed for the data presented	SLO measured
Students will be able to effectively use nomenclature to name or provide structures of organic compounds.	1,3
Students will be able to classify organic compounds into various groups such as functional groups or reaction types.	1,3
Applications Project: Poster presentation including: Theory, reactions, synthesis, structure, etc...	1,3
Students will be able to collect, analyze and present data and results effectively in the form of laboratory reports, or research papers, or research posters.	2,4

Results, discussions and changes made from results: (Data on separate Excel sheet)

Results: The small class size (8 students) for spring 07 may be a factor to the higher student outcomes comparing to spring 08. Overall the results are good for our students earning an A or B for the course, Spring 07 at 100%, 92.3 % for Spring 08, and 100% Spring 09.



Discussions and Changes: Through the semesters that this course has been taught, assessment of Instructors have analyzed the results, discussed results with other faculty and staff, and made appropriate changes to the course to improve the outcome results for students. Changes such as, revised lecture notes, revised PowerPoint presentations, additional problems worked out in class, review sheets, and additional homework problems assigned are examples of some of the techniques instructors have used. I remind students many more times through out the year that for many universities, a B or better is required to transfer. This has encouraged them to keep up their grades.

Participation in SLO Assessment Cycle for GE Outcomes
