

Assessment Report Chemistry Department

Part I-Assessment SUMMARY (2006-2007)

A. Program/Discipline Mission Statement

The mission of the chemistry department, within the physical science department, is to provide learning-centered chemical education to students. The chemistry department strives to educate traditional and non-traditional students who intend to pursue further educational or career opportunities about chemical principles in a dynamic, supportive, learning-centered environment. The chemistry department is committed to integrating appropriate technology, modern instrumentation, traditional and contemporary pedagogical approaches, and assessment of student achievement into classes in an attempt to create an environment that engages students in classroom activities that facilitate learning for students of all learning styles.

B. Intended Outcomes

After successfully completing a chemistry course (including the lecture and laboratory components) at Arapahoe Community College,

1. A student will demonstrate mastery of competencies identified on the competency-based syllabus for that specific course.
2. A student will acquire the ability to analyze data, consider problems, and propose scientifically reasonable and acceptable solutions to these problems.
3. A student will acquire the ability to use chemical apparatus, instrumentation and equipment properly and safely.
4. A student will demonstrate mastery of the approach and rationale of the scientific method and be able to apply these principles to solve problems.
5. A student will demonstrate the ability to read scientific literature and to discuss topics that are relevant to and appropriate for a specific course.

C. Benchmarks

Benchmarks for each of the four assessment activities administered by the chemistry department have been established.

Assessment activity #1: The American Chemical Society (ACS) standardized exam
Benchmark: The student average on this exam should be the same as or higher than the national average. (Outcome: 1)

Assessment activity #2: The American Chemical Society (ACS) Toledo Exam

This exam is a diagnostic exam used to determine if students are prepared to take CHE 111. The grades on this exam will be correlated with final grades in CHE 111. This exam will be used to track retention through CHE 111.

Benchmark: 95% of students enrolled in CHE 111 will take this exam. 75% of students who are prepared to take CHE 111 (as predicted by their scores on the Toledo exam) will successfully complete CHE 111. (Outcome: 1)

Assessment activity #3: Standardized Final Exam in General College Chemistry I

This exam is designed by the chemistry faculty and is administered as the final cumulative exam for all CHE 111 sections. Data will be collected on student performance to assess each content area for General College Chemistry I. (Outcome: 1, 2)

Benchmark:

1. 75% of the groups will score a 75% on the exam.
2. 10% of the groups will score a 90% on the exam.

Assessment activity #4: Laboratory Practical QA in General College Chemistry I

Benchmarks: (Outcome: 1, 2, 3, 4, 5)

1. 75% of the groups will score a 2 on a scale from 0 to 4 in each area reviewed.
2. 15% of the groups will score a 4 on a scale from 0 to 4 in each area reviewed.

Assessment activity #5: Guided Inquiry Experiment in General College Chemistry II

Benchmarks: (Outcome: 1, 2, 3, 4, 5)

1. 75% of the groups will score a 2 on a scale from 0 to 4 in each area reviewed.
2. 15% of the groups will score a 4 a scale from 0 to 4 in each area reviewed.

D. Assessment Results

1. Historical Context

Faculty who teach in the chemistry department are dedicated to helping students learn the required content and skills in each course they teach. Faculty use the results of previous year's assessment activities to evaluate course requirements, course activities, and instructional strategies.

A variety of techniques are used to assess student understanding of information that is learned in the classroom as well as in the laboratory.

The faculty in the chemistry department strive to teach students content as well as skills that students will use throughout their academic and professional careers. To this end, the faculty in the chemistry department uses a variety of projects to help teach students the skills we feel are essential for their success in the chemistry classroom and beyond. For example: the ACS Toledo Exam assesses if students are sufficiently prepared (with respect to pre-requisite chemistry content knowledge as well as math skills) to take general college chemistry (CHE 111); ACS exams are used to assess content knowledge; A guided inquiry approach to teaching general

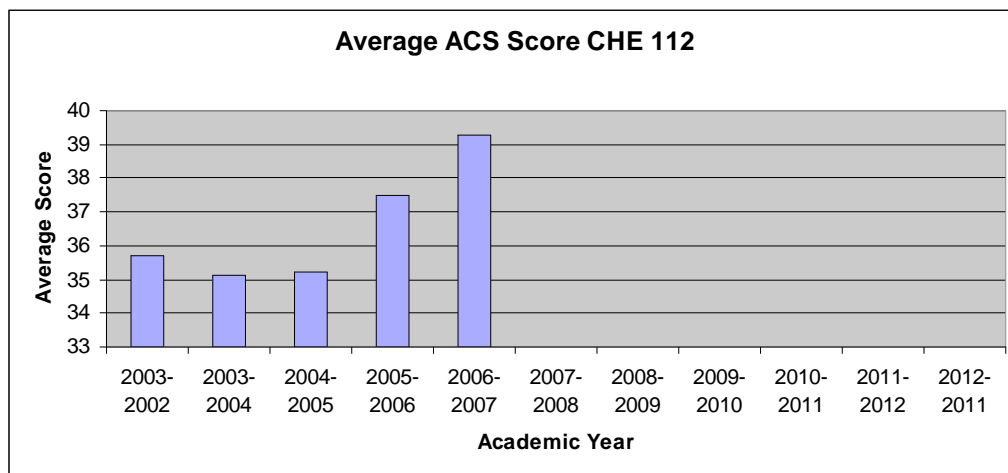
chemistry labs; Students are expected to prepare posters about their guided inquiry experiments in general college chemistry (CHE 112);

2. Current Year Data Results

Assessment activity #1: ACS Standardized exam

The ACS standardized exam was administered to 37 students enrolled in CHE 112 (General College Chemistry II) in during the fall, 2005 and spring, 2006 semesters. This was an embedded assessment. The average score on this exam was 39.27 out of 70. The national average on this exam is 41.0 out of 70. These results fail to meet the benchmark established for this assessment activity.

The following graph represents the average score on the ACS exam per academic year.



Assessment activity #2: The American Chemical Society (ACS) Toledo Exam

This was the second year that the ACS Toledo Exam results were used as part of the chemistry assessment. The ACS Toledo Test of Basic Skills determines if students are adequately prepared (with respect to chemistry and math content) to begin CHE 111 – general college chemistry.

Ninety-nine students took the exam in the fall, 2006 and spring, 2007 semesters. Of these, 81 students completed CHE 111 with a grade of C or better. (C is transferable. Grades of “D” were not included as being retained, as these students will need to retake CHE 111 if they intend to transfer the class to a four-year institution.) This is 81.82% retention rate overall.

Assessment activity #3: Standardized Final Exam in General College Chemistry I

This was the first year a standardized exam was proposed as an assessment tool. After further review it was decided to postpone the use of a standard exam until all faculty and instructors could take part in its creation, therefore, no data was collected for this assessment activity.

Assessment activity #4: Laboratory Practical QA in General College Chemistry I

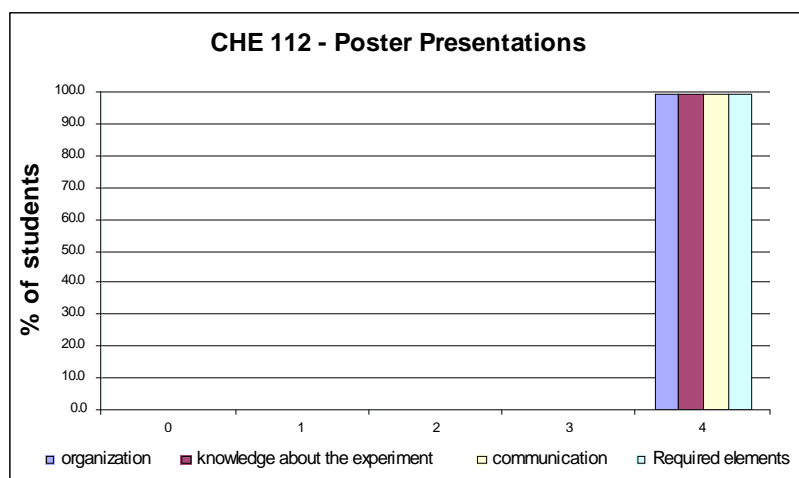
This was the first year a lab practical was proposed as an assessment tool. After further review it was decided to postpone the administration of a laboratory practical due to the overhaul and changing of all lab experiments for the General Chemistry courses in the fall 2007 semester, therefore, no data was collected for this assessment activity.

Assessment activity #5: Poster Presentation: Guided Inquiry Experiment in General College Chemistry II (CHE 112)

Four criteria were selected from the rubric used to evaluate the posters. These criteria are:

1. The material is organized in a logical sequence and with a clear structure. (Organization)
2. The poster provides evidence of knowledge and understanding of the experiment. (Knowledge about experiment)
3. The poster communicates clearly and effectively with the reader. (Communication)
4. All required elements of the poster present. (Required elements)

The graph below represents how students performed in each of the four categories evaluated.



3. Analysis

Assessment activity #1:

The American Chemical Society (ACS) standardized exam

Benchmark: The class average on this exam should be the same as or higher than the national average.

Students enrolled in CHE 112 did not achieve the benchmark established for this activity. The national average on this exam is 58.61%. The average score for ACC students is 56.1%.

Only 37.84% of students scored at or above the national average on this exam

ACS standardized exams assesses many of the course competencies established for CHE 111/112. (Course competencies for CHE 111/112 were established by chemistry instructors as part of the Common Course Numbering project. These course competencies are available online at

<http://ccens.ccs.ccoes.edu/combo.asp?prefix=CHE>)

The average student score on the ACS exam in 2006-2007 is still below the national average. It is important to note, however, that the results of this year's assessment indicate that students performed better on the ACS exam than in previous years.

This result may be explained by the following:

1. Improved instruction
 - As a result of the previous assessment, instructors may have addressed mathematical concepts more effectively in CHE 111/112.
2. A different group of students
 - The improved scores may simply be a result of changing the group of students who took the exam.
3. A combination of instruction and students
4. Another unidentified factor.

The ACS exam will be used again in the 2007-2008 academic year. It is hoped that student performance on this exam will continue to improve.

Assessment activity #2: The American Chemical Society (ACS) Toledo Exam

Benchmark: 95% of students enrolled in CHE 111 will take this exam. 75% of students who are prepared to take CHE 111 (as predicted by their scores on the Toledo exam) will successfully complete CHE 111. ([Outcome: 1](#))

All of the students enrolled in CHE 111 in the fall, 2006 and spring, 2007 semesters who attended the first laboratory session took the ACS Toledo exam.

Results from this year's assessment show a 81.82% retention rate. This value exceeds the established benchmark of 75%.

Enough data was collected this year to compare the Toledo score with students overall grade as summarized below.

- **75.76%** of students passed CHE 111 with a grade of C or higher when they received a score of greater than **20** on the Toledo exam.

The data above can be used to assess student performance in CHE 111 related to prior student knowledge in basic mathematical and chemical concepts based on the students Toledo score.

The retention rate of 81.82% does not correlate with the 75.76% Toledo comparison since some students exceeded expectations and received passing grades with low (<20) Toledo scores or for students who entered the class after the Toledo exam was administered.

Assessment activity #3: Standardized Final Exam in General College Chemistry I

Benchmark: (Outcome: 1, 2)

1. 75% of the groups will score a 75% on the exam.
2. 10% of the groups will score a 90% on the exam.

No data was collected due to the reasons stated above.

Assessment activity #4: Laboratory Practical QA in General College Chemistry I

Benchmarks: (Outcome: 1, 2, 3, 4, 5)

1. 75% of the groups will score a 2 on a scale from 0 to 4 in each area reviewed.
2. 15% of the groups will score a 4 on a scale from 0 to 4 in each area reviewed.

No data was collected due to the reasons stated above.

Assessment activity #5: Guided Inquiry Experiment in General College Chemistry II

Benchmarks: (Outcome: 1, 2, 3, 4, 5)

1. 75% of the groups will score a 2 on a scale from 0 to 4 in each area reviewed.
2. 15% of the groups will score a 4 a scale from 0 to 4 in each area reviewed.

All students received a score of 4 in all criteria, indicating that this assessment activity is no longer an appropriate means of assessing the program. It will therefore be removed from future assessment plans and be replaced by a more meaningful assessment activity.

C. Use of Results

This assessment report will be shared with all faculty (full time and adjunct) who teach in the chemistry department.

The results of these assessment activities will be used to monitor, review, re-evaluate, and, if necessary, revise the goals of the CHE 111/112 curricula.

Part II – Assessment PLAN (Academic Year 2007-2008)

A. Intended Outcomes

- Please see **Part I-B**

B. Identify Assessment Procedures/Methods

Learning outcome	ACS Final Exam CHE 111 CHE 112	ACS Toledo Exam CHE 111	Laboratory Practical QA CHE 111	Laboratory Practical QA CHE 112	Laboratory Notebook CHE 111 CHE 112	Literature Referencing CHE 111 CHE 112
Demonstrate mastery of competencies identified by the competency-based syllabus for that specific course.	X	X	X	X	X	
Acquire the ability to analyze data, consider problems, and propose scientifically reasonable and acceptable solutions to these problems.	X	X	X	X	X	
Acquire the ability to use chemical apparatus, instrumentation and equipment properly and safely.			X	X		
Demonstrate mastery of the approach and rationale of the scientific method and be able to apply these principles to solve problems.			X	X	X	
Demonstrate the ability to read and write about scientific literature that is relevant and appropriate to a specific course.						X

C. Benchmarks

Benchmarks for each of the four assessment activities administered by the chemistry department have been established.

Assessment activity #1: The American Chemical Society (ACS) standardized exam

This exam is a cumulative exam addressing all topics covered in General College Chemistry I and II.

Benchmark: The class average on this exam should be the same as or higher than the national average. (Outcome: 1, 2)

Assessment activity #2: The American Chemical Society (ACS) Toledo Exam

This exam is a diagnostic exam used to determine if students are prepared to take CHE 111. The grades on this exam will be correlated with final grades in CHE 111. This exam will be used to track retention through CHE 111.

Benchmark:

1. 95% of students enrolled in CHE 111 will take this exam.
2. 75% of students who are prepared to take CHE 111 (as predicted by their scores on the Toledo exam) will successfully complete CHE 111. (Outcome: 1, 2)

Assessment activity #3: Quantitative Analysis Laboratory Practical in General College Chemistry I

The practical will involve standardizing a sodium hydroxide solution by titrating it with a standard KHP solution. The standardized sodium hydroxide solution will then be used to determine the concentration of an unknown acid solution, using acid-base titration techniques. (Outcome: 1, 2, 3, 4)

Benchmark:

1. 75% of the groups will determine their unknown acid concentration within a 10 - 30% error range.
2. 10% of the groups will determine their unknown acid concentration within a 0 – 10% error range.

Assessment activity #4: Qualitative Analysis Laboratory Practical in General College Chemistry II

The practical will involve detecting and identifying the elements present in an unknown mixture of 4 elements using qualitative analysis. (Outcome: 1, 2, 3, 4)

Benchmarks:

1. 75% of the groups will correctly identify two of the four unknown substances in their sample.
2. 15% of the groups will correctly identify all four unknown substances in their sample.

Assessment activity #5: Laboratory Notebook in General College Chemistry I and II

Laboratory notebooks will be reviewed and assessed at the end of each semester using a standard rubric. Seven components (Table of Contents, Purpose, Procedures, Data Collection, Tabulated Results, Discussions, Completion Signatures, and Dates) of the lab notebook will be reviewed on a scale of 0 to 4. (Outcome: 1, 2, 3, 4)

Benchmarks:

1. 75% of the groups will score a 3 on a scale from 0 to 4 in each component reviewed.
2. 15% of the groups will score a 4 on a scale from 0 to 4 in each component reviewed.

**Assessment activity #6: Literature Referencing (CRC and Online sources)
General College Chemistry I and II**

Each student will complete a physical property reference card for a given chemical using the CRC and online resources. Students will be assessed on whether the data is recorded properly with correct numbers and units. (Outcome: 5)

Benchmarks:

1. 75% of the groups will score a 3 on a scale from 0 to 4 in accordance to card completion.
2. 15% of the groups will score a 4 on a scale from 0 to 4 in accordance to card completion.